

**Rock River Water Reclamation District
Rockford, Illinois**

Bidding Requirements and Contract Forms

for

RAS Pump Replacement Phase 2

Capital Project No. 1859

Rock River Water Reclamation District Rockford, Illinois

**Bidding Requirements and Contract Forms
and
General Provisions and Technical Specifications
for
Sanitary Sewer Construction**

for

RAS Pump Replacement Phase 2

Capital Project No. 1859

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 - Section 02160 – Temporary Excavation Support Systems
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Not to be used for bidding purposes

Not to be used for bidding purposes

Section I

Bidding Requirements

Article 1 — Notice to Bidders

The Rock River Water Reclamation District (District) will receive sealed and signed bids for the RAS Pump Replacement Phase 2, Capital Project No. 1859, sewerage improvements at the District office, 3501 Kishwaukee Street, Rockford, Illinois until 10:00 a.m. on Wednesday, May 29, 2019 at which time and place all bids will be publicly opened and read aloud.

The RAS Pump Replacement Phase 2, Capital Project No. 1859 consists of demolition and disposal of five pump houses with concrete footings, removal of ten (10) pumps and motors, removal and disposal of pump discharge piping, dewater final clarifier tanks - provide dams, portable pumps and power as needed, installation of reinforcing steel and concrete, shore existing elevated concrete slab and perform selective slab demolition, cast pump access hatches and electrical conduits in elevated slab and repair deck surface, install ten (10) District-supplied Return Sludge Pumps with local control panels and appurtenances, provide and install check and isolation valves for each pump along with new discharge piping, provide six (6) new yard hydrants, remove six (6) old fire hydrants and seal water piping, provide and install 14 VFDs, other electrical and control work, site restoration and all other appurtenances as indicated on the plans and in the specifications.

Bidder's attention is called to Article 2 – Instructions to Bidders 3.8 requirements for Statement of Qualifications. Bidder must have a permanent business office within forty (40) miles of the District office at 3501 Kishwaukee Street in Rockford, IL.

Substantial completion (all ten new pumps installed and fully functional) shall be July 15, 2020. Final completion shall be July 31, 2020. Liquidated damages shall be \$300.00 per each consecutive calendar day for each completion date.

Bid documents may be obtained at a cost of \$50 per set (non-fundable) by contacting the District Engineering Department at 815.387.7660.

Plans and specifications may also be viewed at the offices of the Northern Illinois Building Contractors Association at 1111 S. Alpine Rd, Rockford, IL. For more information, visit the District website at www.rwrwd.dst.il.us.

All construction will be done in accordance with specifications on file with the District, including the *General Provisions and Technical Specifications for Sanitary Sewer Construction* (Current Edition) by the Rock River Water Reclamation District of Rockford.

Each proposal must be accompanied by the District Bid Bond form with an acceptable Bid Security attached, in the amount of five percent (5%) of the total bid price. This sum is a guarantee that, if the Proposal is accepted, a contract will be entered into and its performance properly secured.

A Mandatory Pre-Bid Meeting for this project will be held on Wednesday, May 8, 2018 at 11:00 a.m. at the RRWRD Board Room, 3501 Kishwaukee Street, Rockford, Illinois. All contractors that intend to bid on this project must attend the pre-bid meeting.

The successful bidder will be required to furnish a satisfactory performance bond in the full amount of the bid or proposal. No bid shall be withdrawn without the consent of the District for a period of sixty (60) days after the scheduled time of receiving bids.

The Rock River Water Reclamation District, reserves the right to reject any or all bids, or any part thereof, or to accept any bid or any part thereof, or to waive any formalities in any bids, deemed to be in the best interest of the Rock River Water Reclamation District.

Dated this 1st day of May, 2019.



BY: Chris Black, Business Manager

Not to be used for bidding purposes

Article 2 — Instructions to Bidders

1 General

1.1 Scope and Intent

This section of the contract documents is concerned with furnishing detailed information and requirements for preparing bids to prospective bidders, bidders' responsibility, the preparation and the submission of bids, basis for awarding the contract and other general information concerned with bidding and executing the contract.

1.2 Contradictions

If in the case of apparent contradiction between or among the Contract Documents, the Contract Documents shall be consulted in the following order: Addenda, Agreement, Supplementary Drawings, Instructions to Bidders, Detailed Specifications, Plans, District General Provisions and Technical Specifications for Sanitary Sewer Construction. The language in the first such document in which language regarding the conflict, error or discrepancy occurs shall control.

2 Legal Requirements

2.1 Illinois Regulations

1. The undersigned, as Bidder, declares he will comply with prevailing wages in accordance with the Illinois Department of Labor Standards. The State of Illinois requires contractors and subcontractors on public works projects (including the District) to submit certified payroll records on a monthly basis, along with a statement affirming that such records are true and accurate, that the wages paid to each worker are not less than the required prevailing rate and that the contractor is aware that filing false records is a Class B Misdemeanor.

The certified payroll records must include the name, address, telephone number, social security number, job classification, hourly wages paid in each pay period, the number of hours worked each day, and the starting and ending time of work each day, for every worker employed on the project. Any contractor who fails to submit a certified payroll or knowingly files a false certified payroll is guilty of a Class B Misdemeanor. Certified payroll reports shall be submitted on standard IDOT forms.

2. Public Act 83-1030 entitled "Steel Products Procurement Act" requires that steel products used or supplied in performance of this contract or subcontract shall be manufactured or produced in the United States with three exceptions.

The provisions of this Section shall not apply:

- a. Where the contract involves an expenditure of less than \$500.
 - b. Where the executive head of the public agency certifies in writing that
 - i. the specified products are not manufactured or produced in the United States in sufficient quantities to meet the agency's requirements, or
 - ii. obtaining the specified products, manufactured or produced in the United States would increase the cost of the contract by more than 10%.
 - c. When its application is not in the public interest.
3. Public Act 96-929 (30 ILCS 570) provides that Illinois residents be employed on Illinois public works projects, provided there has been a period of excessive unemployment (5%) in the State

of Illinois as defined in the Act; and, further, that Illinois workers are available and capable of performing the particular type work involved.

4. Public Act 99-0933 requires that any party to a contract adopt and promulgate written sexual harassment policies that include, as a minimum, the following information:
 - a. the illegality of sexual harassment
 - b. the definition of sexual harassment under Illinois State law
 - c. a description of sexual harassment, utilizing examples
 - d. my (our) organization's internal complaint process including penalties
 - e. the legal recourse, investigative and complaint process available through the Illinois Department of Human Rights and the Illinois Human Rights Commission
 - f. directions on how to contact the Department and the Commission
 - g. protection against retaliation as provided by Section 6-101 of the Illinois Human Rights Act

Upon request, this information shall be provided to the Illinois Department of Human Rights and the District.

5. With regard to nondiscrimination in employment, the Contractor for this project will be required to comply with the Illinois Fair Employment Practices Commission's Rules and Regulations.
6. The Contractor for this project shall comply with the Occupational Safety and Health Act.
7. The Contractor for this project shall comply with the Federal Drug-Free Workplace Act.
8. Public Act 96-1416 requires the Certification of Clean Construction and Demolition Debris (CCDD) and uncontaminated soil prior to disposal at a CCDD fill site. The Contractor for this project shall comply with Public Act 96-1416 and be responsible for the certifications and any fees associated with the disposal at a CCDD fill site.
 - a. In the event that contaminated soil is uncovered on the project, the Contractor shall notify the District immediately. Any extra costs resulting from the presence of contaminated soil shall be evaluated in accordance with District General Provisions & Technical Specs for Sanitary Sewer Construction; General Conditions: Article 5 – Time Provisions and Article 8 – Changes.

2.2 Americans with Disabilities Act

The Contractor for this project will comply with all applicable requirements of the Americans with Disabilities Act of 1990 (ADA). The Contractor will hold harmless and indemnify the District and their representatives from all:

1. suits, claims, or actions
2. costs, either for defense (including but not limited to reasonable attorney's fees and expert witness fees) or for settlement
3. damages of any kind (including but not limited to actual, punitive, and compensatory damages)

relating in any way to or arising out of the ADA, to which said firm is exposed or which it incurs in the execution of the contract.

3 General Instructions

3.1 Bidder's Responsibility

Bidders are cautioned not to submit proposals until having carefully examined the entire site of the proposed work and adjacent premises and the various means of approach and access to the site, and having made all necessary investigations to inform themselves thoroughly as to the facilities for delivering, placing and handling the materials at the site, and having informed themselves thoroughly as to all difficulties involved in the completion of all the work under this Contract in accordance with its requirements.

Bidders must examine the Plans, Specifications and other Contract Documents and shall exercise their own judgment as to the nature and amount of the whole of the work to be done and for the bid prices must assume all risk of variance, by whomsoever made, in any computation or statement of amount or quantities necessary to complete fully the work in strict compliance with the Contract Documents. The Bidder must satisfy himself by making borings or test pits, or by such methods as he may prefer, as to the character and location of the materials to be encountered or work to be performed. No pleas of ignorance of conditions that exist or that may hereafter exist, or of conditions or difficulties that may be encountered in the execution of the work under this Contract, as a result of failure to make the necessary examinations and investigations, will be accepted as an excuse for any failure or omission on the part of the Contractor to fulfill, in every detail, all of the requirements of the Contract Documents, or will be accepted as a basis for any claims whatsoever for extra compensation or for an extension of time.

The Contractor is responsible for verifying the location of all existing utilities in the project areas.

The Bidder, therefore, shall satisfy himself by such means as he may deem proper as to the location of all structures that may be encountered in construction of the work.

3.2 Addenda and Interpretations

No interpretation of the meaning of the Plans, Specifications, or other Contract Documents will be made to any bidder orally. Every request for such interpretation must be in writing addressed to the District, Attn: Engineering Manager, 3501 Kishwaukee Street, Rockford, Illinois, 61109. To be given consideration, such request must be received at least five (5) days prior to the date fixed for the opening of bids. Any and all such interpretations and any supplemental instructions will be in the form of written addenda which, if issued, will be sent by email, fax, or certified mail with acknowledgement of receipt requested, to all prospective bidders, at the respective addresses furnished for such purposes, not later than three (3) days prior to the date fixed for the opening of bids. Failure of any bidder to receive any such addenda or interpretation shall not relieve said bidder from any obligation under his bid as submitted. All addenda so issued shall become part of the Contract Documents.

3.3 Laws and Regulations

The prospective bidder is warned that he must comply with all laws of the United States Government, State of Illinois, all ordinances and regulations of the District in the performance of the work under this contract. The Bidder's attention is specifically called to that provision of the General Conditions regarding the rate of wage to be paid on the work.

3.4 Quantities Estimated Only

Bidders are warned that the estimate of quantities of the various items of work and materials, as set forth in the proposal form, is approximate only and is given solely to be used as a uniform basis for the comparison of bids. The quantities actually required to complete the contract work may be less or more than so estimated, and if awarded a contract for the work specified, the Contractor further agrees that he will not make any claim for damages or for loss of profits or for an extension of time because of a difference between the quantities of the various classes of work assumed for comparison of bids and quantities of work actually performed.

3.5 Form, Preparation, and Presentation of Proposals

For particulars as to the quantity and quality of the supplies, materials and equipment to be furnished, and the nature and extent of the work or labor to be done, prospective bidders are referred to the Contract Documents, which may be examined or obtained at the office of the District.

Each bid will be submitted upon the prescribed proposal form. All blank spaces for bid prices must be filled in, in ink, with the unit or total sum or both for which the proposal is made. If the proposal contains any omissions, erasures, alterations, additions or items not called for in the itemized proposal, or contains irregularities of any kind, such may constitute sufficient cause for rejection of bid. In case of any discrepancy in the unit price or amount bid for any item in the proposal, the unit price as expressed in figures will govern. In no case is the agreement form to be filled out or signed by the bidder.

The Contractor may opt to contact the District's Engineering Department at 815.387.7660 to obtain an electronic Proposal form. If used, this form must be attached to the hard copy proposal form and appropriately signed and executed with the bid.

The bid must be verified and be presented on the prescribed form in a sealed envelope on or before the time and at the place stated in the Advertisement for Bids, endorsed with the name of the person, firm or corporation presenting it, the date of presentation, and the title of the work for which the bid is made. If forwarded by mail, the sealed envelope containing the proposal and marked as directed above, must be enclosed in another envelope addressed to Clerk of the District, 3501 Kishwaukee Street, Rockford, Illinois, 61109 and be sent preferably by certified mail. The District will not accept facsimile generated bids.

3.6 Bid Security

Each proposal must be accompanied by the District Bid Bond form with an acceptable Bid Security attached, in the amount specified in Article One, Notice to Bidders. This sum is a guarantee that, if the Proposal is accepted, a contract will be entered into and its performance properly secured. The District's Bid Bond Form included in the bid packet must be used. No other Bid Bond form may be substituted.

Within ten (10) days after the opening of bids, the deposits of all but the three lowest bidders will be returned. The deposits of the remaining two unsuccessful bidders will be returned within three (3) days after the execution of the contract, or, if no such contract has been executed, within sixty (60) days after the date of opening bids. The deposit of the successful bidder will be returned only after he has duly executed the contract and furnished the required bond and insurance.

3.7 Affidavit of Compliance

Each proposal must be accompanied by an executed Affidavit of Compliance. A separate Affidavit of Compliance form is enclosed with the Proposal packet. Failure to submit an executed Affidavit of Compliance with the proposal may constitute sufficient cause for rejection of the bid.

3.8 Statement of Qualifications

Each proposal must be accompanied by a Statement of Qualifications certifying that the bidder is registered to do business in the State of Illinois, has a permanent business office within forty (40) miles of the District office at 3501 Kishwaukee Street in Rockford, IL, and provides documentation that the bidder possesses the appropriate financial, material, equipment, facility and personnel resources and expertise necessary to meet all contractual obligations. The bidder shall document no less than three (3) contracts for sanitary sewer system within the past five (5) years having equal or greater value to the bid being submitted. The District reserves the right to request additional information as needed to evaluate bids prior to making an award.

3.9 Comparison of Proposals

Bids on item contracts will be compared on the basis of a total computed price arrived at by taking the sum of the estimated quantities of each item, multiplied by the corresponding unit prices and including any lump sum bids on individual items, in accordance with the estimate of quantities set forth in the proposal form. Bids on lump sum contracts will be considered upon the basis of the lowest sum bid.

3.10 Acceptance of Bids and Basis of Award

No bidder may withdraw his bid after the scheduled closing time for receipt of bids, for at least sixty (60) days.

The contract will be awarded, if at all, to the lowest responsive, responsible bidder. The District also reserves the right to reject any or all bids.

The bidder whose proposal is accepted shall enter into a written contract for the performance of the work and furnish the required bonds and insurance certificate within ten (10) days after written notice by the Engineering Manager of the District has been served on such bidder personally or by mailing a postpaid wrapper to such bidder at the address given in his proposal. If the bidder to whom the contract is awarded refuses or neglects to execute it or fails to furnish the required bond and insurance within five (5) days after receipt by him of the notice, the amount of his deposit shall be forfeited and shall be retained by the District as liquidated damage and not as a penalty. It being now agreed that said sum is a fair estimate of the amount of damages that the District will sustain in case said bidder fails to enter into a contract and furnish the required bond and insurance. No plea of mistake in the bid shall be available to the bidder for the recovery of his deposit or as a defense to any action based upon the neglect or refusal to execute a contract.

3.10.1 Evaluation of Responsiveness

The responsiveness of bidders will be judged on the basis of the completeness of the bid submitted. To be responsive, a Bid must be submitted on the forms provided as part of the Bid Documents and comply with all the requirements of the Instruction to Bidders.

3.10.2 Evaluation of Responsibility

To be judged as responsible, the bidder shall:

- a. Have adequate financial resources for performance, the necessary experience, organization, technical qualifications, and facilities, or a firm commitment to obtain such by subcontracts;
- b. Be able to comply with the required completion schedule for the project;
- c. Have a satisfactory record of integrity, judgment, and performance, including, in particular, any prior performance on contracts from the District;
- d. Have an adequate financial management system and audit procedures, that provide efficient and effective accountability and control of all property, funds, and assets;
- e. Conform to the civil rights, equal employment opportunity and labor law requirements of the Bid Documents.
- f. Have satisfactorily completed no less than three (3) sanitary sewer system contracts within the past five (5) years of equal or greater value to the bid being submitted.

3.11 The Rejection of Bids

The District reserves the right to reject any bid if the evidence submitted in the statement of the bidder's qualifications, or if investigation of such bidder fails to satisfy the District that such bidder is properly qualified to carry out the obligations and to complete the work contemplated therein. Any or all proposals will be rejected if there is reason to believe that collusion exists among the bidders. Conditional bids will not be accepted. The District reserves the right to reject any and all bids and to accept the bid which they deem most favorable to the interest of the District after all proposals have been examined and canvassed.

3.12 Insurance and Bonding

Contractor shall provide all necessary insurance and bonds required to complete the project. No more than ten (10) calendar days subsequent to the District's issuance of an award letter, the Contractor shall provide documentation to prove that he has obtained all required insurance and bonds. The District shall be the sole judge as to the acceptability of any such proof.

Contractor shall provide and maintain all insurance and bonds as required by the District.

3.12.1 General

The Contractor shall ensure that:

1. All insurance policies shall be specific to the project.
2. The insurance certificate shall state: This certifies that the insurance coverage meets or exceeds that required for RAS Pump Replacement Phase 2, Capital Project No. 1859.
3. The District shall be named as Additional Insured in all policies; this shall include the Owners Contractors Protective Policy option.

4. All completed operations coverages and bonds shall remain in force for a period of two (2) years following acceptance of the project and completed operations shall stay in force for two (2) years following completion of the project.

3.12.2 Insurance

The Contractor shall, for the duration of the contract and for two (2) years following project acceptance, maintain the following:

1. General Liability: \$1,000,000 combined single limit per occurrence for bodily injury, personal injury and property damage. If Commercial General Liability Insurance or other form with a general aggregate limit is used, either the general aggregate limit shall apply separately to this project or the general aggregate limit shall be twice the required occurrence limit. The Contractor shall provide "XCU" coverage.
2. Automobile Liability: \$1,000,000 combined single limit per accident for bodily injury and property damage including coverages for owned, hired or non-owned vehicles, as applicable.
3. Workers' Compensation and Employers Liability: Workers' Compensation limits as required by statute and Employers Liability limits of \$500,000 per accident and \$500,000 per disease.
4. Umbrella: \$2,000,000 per occurrence/aggregate for contracts valued at \$500,000 or over, or \$1,000,000 for contracts below \$500,000. \$10,000 is maximum allowable self-retained limit.
5. Errors and Omissions: If the Contractor performs professional services, he shall maintain errors and omissions insurance with a limit no lower than \$1,000,000 for the duration of the contract.

The policies shall contain, or be endorsed to contain, the following provisions in the General Liability and Automobile Liability Coverage's:

- a. Unless otherwise provided in paragraph "c" of this section, the District, its officers, officials, employees and volunteers shall be covered as additional insureds as respects liability arising out of activities performed by or on insured's general supervision of the Contractor, products and completed operations of the Contractor, premises owned, occupied or used by the Contractor, or automobiles owned, leased, hired or borrowed by the Contractor. The coverage shall contain no special limitations on the scope of protection afforded to the District, its officers, officials, employees, volunteers, or agents.
- b. Unless otherwise provided in paragraph "c" of this section, the Contractor's insurance coverage shall be primary insurance as respects the District, its officers, officials, employees, volunteers, and agents. Any insurance or self-insurance maintained by the District, its officers, officials, employees, volunteers, or agents shall be excess of the Contractor's insurance and shall not contribute with it.
- c. As an acceptable alternative to provisions "a" and "b" of this section, the Contractor may provide owner's and contractor's protective liability insurance with coverage

limits, named insureds, and in conformity with all applicable specifications of this section.

- d. Any failure to comply with reporting provisions of the policies shall not affect coverage provided to the District, its officers, officials, employees, volunteers, or agents.
- e. The Contractor's insurance shall apply separately to each insured against whom claim is made or suit is brought, except with respect to the limits of the insurer's liability.
- f. All Coverages — Each insurance policy required by this clause shall not be suspended, voided, canceled by either party, reduced in coverage, or in limits except after thirty (30) days' prior written notice by certified mail, return receipt requested, has been given to the District.

3.12.3 Best's Ratings

The District shall be the sole judge of whether or not said insurer's ratios are satisfactory. The District's decision shall be final and the District's bidding procedures contain no appeal provision.

1. **Alphabetical Rating:** For purposes of this Request for Bids, "insurer" shall mean any surety, insurance carrier, or other organization which proposes to provide an insurance policy or bond for the Contractor. No insurer or surety rated lower than "A-, Excellent" in the current *Best's Key Rating Guide* shall be acceptable to the District.
2. **Financial Size Rating:** Provided an insurer's alphabetical rating is satisfactory, the District will examine said insurer's financial size rating.
 - a. If Best classifies the insurer XII or larger, said insurer shall be acceptable to the District.
 - b. If Best classifies the insurer as smaller than XII, but larger than VI, said insurer shall be submitted to the District's Business Manager and/or the District's insurance consultant for review.

Financial Size ratings less than VII are not acceptable and will disqualify the Contractor.

3.12.4 Performance Bond and Labor & Materials Payment Bond Form

The Contractor shall provide a Performance Bond and Labor & Materials Payment Bond form acceptable to the District. The performance bond shall be for either 100% of the contract price or for the Contractor's unit price times the estimated number of units, as applicable.

This Request for Bids contains a Performance Bond and a Labor & Material Bond form for the Contractor's use.

If the Contractor fails to provide acceptable bonds within the specified time, he shall be in default.

3.12.5 Correction of Contractor's Insurance or Bond Deficiencies

If the District determines that the Contractor's insurance or bond documentation does not conform to these specifications, the District shall inform said Contractor of the non-conformity. If said

Contractor fails to provide conforming insurance or bond documentation within five (5) calendar days of the District's deficiency notice, he shall be in default.

3.12.6 Indemnification Clause

Contractor shall protect, indemnify, hold and save harmless and defend the District, its officers, officials, employees, volunteers, and agents against any and all claims, costs, causes, actions and expenses, including but not limited to attorney's fees incurred by reason of a lawsuit or claim for compensation arising in favor of any person, including the employees, officers, independent contractors, or subcontractors of the Contractor or District, on account of personal injuries or death, or damages to property occurring, growing out of, incident to, or resulting directly or indirectly from the performance by the Contractor or subcontractor, whether such loss, damage, injury or liability is contributed to by the negligence of the District or by premises themselves or any equipment thereon whether latent or patent, or from other causes whatsoever, except that the successful bidder shall have no liability for damages or the costs incident thereto caused by the sole negligence of the District.

The indemnification shall not be limited by a limitation on amount or type of damages payable by or for the Contractor or its subcontractor under any employee benefits act including, but not limited, to the Workers Compensation Act.

No inspection by the District, its employees, or agents shall be deemed a waiver by the District of full compliance with the requirements of the Contract. This indemnification shall not be limited by the required minimum insurance coverages in the Contract.

3.13 Tax Exemption

The District is exempt, by law, from paying bidder Federal Excise Tax and Illinois Retailers' Occupational Tax. Therefore, the bidder shall exclude those taxes from his bid. The District's tax exemption number is E9992-3696-06. The bidder shall include all applicable taxes in his bid price.

Article 3 - Detailed Specifications

3.1 General

Throughout these specifications, the terms “Owner” and “District” shall be synonymous.

The RAS Pump Replacement Phase 2, Capital Project No. 1859 consists of demolition and disposal of five (5) pump houses with concrete footings, removal of ten (10) pumps and motors, removal and disposal of pump discharge piping, dewater final clarifier tanks - provide dams, portable pumps and power as needed, installation of reinforcing steel and concrete, shore existing elevated concrete slab and perform selective slab demolition, cast pump access hatches and electrical conduits in elevated slab and repair deck surface, install ten (10) District-supplied Return Sludge Pumps with local control panels and appurtenances, provide and install check and isolation valves for each pump along with new discharge piping, provide six (6) new yard hydrants, remove six (6) old fire hydrants and seal water piping, provide and install 14 VFDs, other electrical and control work, site restoration and all other appurtenances as indicated on the plans and in the specifications.

3.2 Detailed Specification Sections

- Section 00310 – Equipment Questionnaire
- Section 01010 – Summary of Work
- Section 01046 – Control of Work
- Section 01063 – Miscellaneous Requirements
- Section 01300 – Submittals
- Section 01400 – Quality Assurance
- Section 01500 – Temporary Facilities
- Section 01600 – Control of Materials
- Section 01610 – Delivery, Storage, and Handling
- Section 02050 – Demolition and Alterations
- Section 02160 – Temporary Excavation Support Systems
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- Section 02223 – Screened Gravel
- Section 02224 – Bank-run Gravel
- Section 02225 – Select Borrow
- Section 02435 – Crushed Stone
- Section 02480 – Landscaping
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- Section 03300 – Cast-in-place Concrete
- Section 05530 – Grating
- Section 15056 – Pipe Supports
- Section 15101 – Valves, Hydrants, and Appurtenances
- Section 15370 – Miscellaneous Process Piping and Appurtenances
- Section 16000 – Electrical Requirements
- Section 16480 – Variable-Frequency Drives

Section 00310

EQUIPMENT QUESTIONNAIRE

The Bidder shall enter in the spaces provided the names of the manufacturers of equipment which Bidder proposes to furnish, and shall submit this Equipment Questionnaire with its Proposal. Owner will review and evaluate the information before award of the Contract.

Only one manufacturer's name shall be listed for each item of equipment. Upon award of a contract, the named equipment shall be furnished. Substitutions will be permitted only if named equipment does not meet the requirements of the Contract Documents, the manufacturer is unable to meet the delivery requirements of the construction schedule, or the manufacturer is dilatory in complying with the requirements of the Contract Documents. Substitutions shall be subject to concurrence of Owner and shall be confirmed by Change Order.

Preliminary acceptance of equipment listed by manufacturer's name shall not in any way constitute a waiver of the specifications covering such equipment; final acceptance will be based on full conformity with the Contract Documents.

Failure to furnish all information requested or entering more than one manufacturer's name for any item in this Equipment Questionnaire may be cause for rejection of the Proposal.

<u>Equipment</u>	<u>Manufacturer</u>
1. Plug Valves, Section 15101	_____
2. Check Valves, Section 15101	_____
3. Variable Frequency Drives, Section 16480	_____

END OF SECTION

SECTION 01010

SUMMARY OF WORK

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Contract description.
- B. Owner supplied materials.
- C. Contractor's use of site and premises.
- D. Work sequence.
- E. Owner occupancy.
- F. Construction Work Narrative

1.2 CONTRACT DESCRIPTION

- A. The work of this Contract is located at the District, 3333 Kishwaukee Street, Rockford, IL and shall generally consist of:
 - 1. Demolish and dispose of five (5) wood framed pump houses complete, including concrete slabs, curbs, insulation, framing, siding, roofing, and other materials as indicated.
 - 2. Remove and turn over to Owner ten (10) existing lineshaft pumps and motors, with no more than two (2) off-line at any time.
 - 3. Remove and dispose of pump discharge piping and insulation as indicated.
 - 4. Dewater the final clarifier tanks (no more than 2 at any time). Provide dams and portable pumps and power as needed to keep work areas dry.
 - 5. Install reinforcing steel and partially fill sludge sump with concrete as indicated, where each submersible pump will be located.
 - 6. Shore existing elevated concrete slab and perform slab demolition work in a manner to minimize impact loading on the slab that is to remain.
 - 7. Remove pump support steel channels, anchors, and reinforcing steel as indicated.
 - 8. Cast pump access hatches and electrical conduits in elevated slab and repair deck surface.
 - 9. Install ten (10) District-supplied Return Sludge Pumps (RSP) and appurtenances.
 - 10. Provide and install check and isolation valves for each pump, along with new discharge piping as indicated.

11. Provide six (6) new yard hydrants; remove six (6) old fire hydrants and seal water piping. Cap seal water near corporation stop if not removed with hydrants.
 12. Restore lawn area between the two (2) bituminous roads to grade similar to that prior to the work. Level aggregate roads similar to the remaining bituminous pavement and concrete gutters.
- B. Substantial Completion (all 10 new pumps installed and fully functional): Substantial Completion shall be July 15, 2020.
- C. Final Completion: Final Completion shall be July 31, 2020.

1.3 OWNER SUPPLIED MATERIALS

A. Equipment Supplied by Owner:

1. The Owner will supply ten (10) Sulzer ABS submersible Return Sludge Pumps, aluminum hatches for casting into concrete slab, pump control panels, pump bases, guide rail systems, and appurtenances, all as indicated in the specifications Section 11304 attached to these specifications or as specifically noted on the Contract Drawings.
2. The new equipment will be delivered to District's facility at 3333 Kishwaukee Street and shall be unloaded and stored on site by the Owner.

1.4 CONTRACTOR'S USE OF SITE AND PREMISES

- A. Access to Site is limited between 6:00 am to 4:00 pm Monday through Friday, unless otherwise approved for limited durations on a case by case basis, and requires the Contractor to follow Owner's security measures as described in Section 01500. First shift operations are from 6:30 am to 3:00 pm and second shift from 2:30 pm to 11:00 pm. The Contractor will not be allowed on site between 4:00 pm and 6:30 am.
- B. No work will be allowed on the weekends or holidays observed by Owner unless written request for each event is submitted by Contractor and agreed upon by the Owner.
- C. Construction operations, storage, and staging are limited to the specific areas designated on the Drawings. Contractor shall promptly move materials, equipment, vehicles, etcetera that are impacting Owner's access or operation.
- D. Contractor shall assume full responsibility for security of all their and their subcontractor's materials and equipment stored on the site.
- E. Utility Outages and Shutdown: Coordinate all utility outages and shutdowns with the Owner at least forty-eight (48) hours in advance, unless otherwise specified.

1.5 WORK SEQUENCE

- A. Contractor shall schedule all work and materials to complete the project in a timely manner. Each RSP is critical to the plant operation and each must be returned to service as quickly as possible.
- B. The project primarily requires the Contractor to remove the existing pumps in a sequence such that only two (2) pumps are off-line at a time, except for limited pre-arranged outages where a (four) 4-pump train will be off line for less than twenty-four (24) hours. Four (4) of the 12 RSP pumps tie into a single force main, requiring four (4) pumps to be off-line and piping dewatered when the new pump isolation valves and piping connections are installed.
- C. All materials must be onsite and demolition approved by the Owner prior to starting activity.
- D. The project also requires electrical upgrades, including replacement of twelve (12) Return Sludge Pump VFDs and two (2) Waste Activated Sludge pump VFDs. Existing VFD panel modifications are required as well. Existing wiring between the pump area junction box and the VFD panels as well as to the Plant Control System panel will be re-used but will require minor modifications. New wiring between each VFD and the existing VFD panels is required. VFD replacement shall be coordinated with the return sludge pump outages as best possible to minimize down time of equipment. Coordinate with the Owner for outage of RSP-5, RSP-6, WSP-1, and WSP-2 in order to replace the VFDs and modify the existing panels.
- E. The project also requires seal water piping disconnection/capping, demolition work, and concrete repair work.
- F. The Contractor shall provide temporary electrical power and wiring for the Contractor's final clarifier dewatering pumping equipment and dewatering pump control. Minimal access to 120-volt power is available in the project area and shall not be used for pumping; the Contractor shall plan on using their own generator equipment to power tools as well as for dewatering.
- G. A detailed work sequence is included below. The Contractor may propose modifications to the work sequence, but must submit the modified work sequence to the District for approval prior to the start of any work. Failure to follow the work sequence or secure approval of a modified sequence may invoke Liquidated Damages per the Agreement.

1.6 OWNER OCCUPANCY

- A. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.
- B. Schedule the Work activities to accommodate Owner occupancy, repairs, maintenance, and operation of the treatment plant. Plant roadways need to remain open for equipment access.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 CONSTRUCTION WORK NARRATIVE

This document summarizes the RSP Pumping Equipment Replacement project's general construction sequencing and requirements.

RRWRD pre-purchased the ten (10) submersible RSP pumps, pump appurtenances, ten (10) access hatches, and ten (10) pump control panels. See shop drawings and Specification Section 11304 for scope of District supplied materials. All other materials shall be provided by the Contractor.

This contract includes demolition of five (5) existing pump house structures, pumping equipment demolition, installation of new equipment, and provision of all other materials required for complete project delivery. Temporary facilities shall be included in the work as necessary to maintain operations at all times.

Contractor's project duties are generally summarized in the following paragraphs.

RRWRD will isolate two adjacent final clarification tanks and will drain the tanks as shown to elevation 83.75. The Contractor shall provide pumping equipment and temporary dams to isolate and dewater the Final Clarifier Tanks for work in the sludge sump areas. The tanks are equipped with pressure relief valves that allow ground water to enter the tanks when the groundwater elevation is above the bottom of the tanks. The Contractor shall provide pumping equipment, power, and hoses as necessary to handle this groundwater, as well as precipitation and water that leaks past the tank isolation gates.

Provide temporary power to Contractor supplied portable pumping equipment. Portable equipment shall be adequate to keep the work areas dry.

Clean the sludge sump area. Plant water from the red hydrants near the final clarification tanks can be used for flushing. Once cleaned and dewatered, install reinforcing steel into the existing concrete sumps. Form the work, apply bonding agent to existing concrete, and then pour the concrete fill.

The existing RAS Pumps are susceptible to freezing after pump house removal. The Contractor shall protect existing pumps and seal water system throughout the project to allow continued operation of the existing equipment. This shall include leaving the existing pump houses in service until ready to work at the 2 associated Final Clarifiers, temporary pump and pipe insulation, temporary heating, and any other means required to protect the existing pumps and piping.

Demolish individual pump houses. Remove pumps, concrete footings, slabs, and curbing as

indicated. The existing vertical turbine pump's 9" +/- thick slab shall be saw cut at 12" intervals and removed from the existing 7" thick slab beneath; the existing slab shall be shored prior to the upper slab demolition work. The steel channels, anchors to the slab underside, reinforcing dowels, and steel plates beneath the slab shall be removed along with the 9" slab. All resulting holes through the slab and defects in the existing slab to remain shall be patched.

Where demolished slab's reinforcing steel is doweled into existing slab, cut reinforcing steel 1/2" below the slab surface and patch with grout.

The existing vertical turbine pumps pass through the existing 7" slab, through a rectangular hole saw cut into the slab. Existing concrete shall be selectively demolished for the new pump access hatches to expose the existing reinforcing steel. Mechanical connectors shall be used to tie into at least 50% of the existing north-south orientated #6 bars as indicated. Other new reinforcing steel shall be drilled and epoxied into the existing slab as indicated (a minimum of one new #5 bar shall be poured into the north and south perimeter of the new pump hatch, tied into the existing bars and the new drilled in bars). Cast the new hatches into the existing slab after installation of the pumps, to ensure alignment and ability to remove and replace the pumps through the hatches.

Demolition work shall be performed in a manner to prevent debris from entering the Final Clarification Tanks and channels. Work within the tanks shall include protection of the existing clarifier flights, cross flights, chains, and drives.

Excavate around the existing 14" pump discharge piping as indicated, with shoring of the earth to minimize excavation area. Support existing duct banks and utilities as the piping is exposed. New piping shall pass through the existing plugged wall pipe and connect to the existing 14" piping. The new pipe joints and fittings shall be adjusted as necessary to connect the new piping to the existing piping. Four pumps need to be shut down for installation of the new isolation valves. The new 10" diameter isolation valves and 14"x10" reducers shall be installed in one day to minimize down time on a four tank train. After new valves are installed, temporarily support the new piping and valves to prevent joint separation after the piping system is returned to service and before the new pumps and piping in the Final Clarifier Tanks are installed.

The existing 14" piping should align with the existing 14" wall pipe. To avoid delays, we will assume 2 of the 10 pipes are out of alignment. Contractor shall provide (and install if needed) two sets of 11-1/4 degree MJ elbows and two sets of 22-1/2 degree MJ elbows for use on any of the new 10" diameter pipes as needed to align the existing 14" buried piping with the new 10" diameter piping. If not needed, turn over the fittings to RRWRD.

Provide and install anchors in the concrete sump fill for attachment of the Owner supplied pump bases and install Owner supplied pump rails and pumps.

Provide and install isolation check valves, supports, and piping in the existing tanks.

When the hatch is cast into the slab, a 2" pump conduit shall be cast from the pump panel to the pump area. Slab surfaces shall be levelled and broom finished to match surrounding slab surfaces. Significant defects shall be ground down and re-finished.

Each new pump will be provided with a stainless steel local pump control panel. Each panel shall be mounted on a stainless steel frame as indicated. Fabricate and install new stainless steel support frame as shown. Anchor the support frame to the concrete deck with Type 316 stainless steel anchors and grout beneath the stand.

Disconnect and remove the existing stainless steel junction box for each pair of pumps in the existing pump houses. New junction boxes shall be provided and installed at the existing two 4" and one 2" conduits, with termination strips for all of the existing wiring connections and feeds to equipment. Provide Myer type hubs for all existing and new conduits at the new junction boxes.

Provide new 1-1/4" PVC coated rigid power conduits and 3/4" PVC coated rigid control conduits to the pump control panels, from the new stainless steel junction box.

Provide new 3/4" PVC coated rigid conduit from the stainless steel junction box to the flight drive forward-reverse switches and to the drive motors. Provide seal-tight for connections to each motor.

Provide new PVC coated rigid conduit for all outdoor power wiring and for all control wiring.

Provide and install fourteen (14) new VFDs as specified. Coordinate with the ten (10) replacement pump outages and with the Owner for the four (4) replacement VFDs that are associated with pumps that are not being replaced.

Provide wiring from the modified VFD panels to the fourteen (14) new 15 Hp 23 FLA VFDs in the Aeration Building. The existing panels shall be modified as indicated on the drawings. Voids in the panel covers shall be filled with properly sized seals. A new plate shall be fabricated to cover the three (3) old conduit openings in top of the panel and then three (3) new conduits shall be routed to each VFD from the panel (new VFD conduit entrances do not align with the old VFDs).

The District will terminate any cable modifications required in the PCS-AER panel and the Contractor will complete all other terminations. Contractor shall label all conductors on both ends.

Clean all debris from each Final Clarifier Tank prior to returning to the District. Remove temporary dams and pumping equipment. The District will determine when a Final Clarifier is suitably cleaned and work completed for return to service.

For each pair of Final Clarifier Tanks, start-up and test the two associated Return Sludge Pumps at a time. After a minimum of two (2) days run time, the District will determine if the tanks are fully functional and the next two (2) can be removed from service. The pump manufacturer will be present for start-up of the first two (2) pumps and the fifth and sixth pumps (or another random set of pumps).

Provide six (6) new yard hydrants, six (6) new 4" isolation valves with valve boxes, and miscellaneous fittings for connection of the yard hydrants. Remove 6 old fire hydrants and associated pump seal water piping. Cap seal water near corporation stop, if the seal water connection to the plant water piping is not removed along with the hydrant removal.

Restore lawn area between the two bituminous east-west roads. Provide top soil and level to grade similar to that prior to the work.

Level and compact aggregate for roads where bituminous pavement was removed. Grade shall be level and similar to the remaining bituminous pavement and concrete gutters.

END OF SECTION

Not to be used for bidding purposes

SECTION 01046

CONTROL OF WORK

PART 1 - GENERAL

1.01 PLANT AND HOURS OF CONSTRUCTION:

- A. Furnish plant and equipment which will be efficient, appropriate, and large enough to secure a satisfactory quality of work and a rate of progress which will insure the completion of the work within the Contract Time. If at any time such plant appears to the Engineer to be inefficient, inappropriate, or insufficient for securing the quality of work required or for producing the rate of progress aforesaid, he may recommend that the Contractor increase the efficiency, change the character, or increase the plant equipment, and the Contractor shall take steps as necessary to improve upon the procedures. Failure of the Engineer to make such suggestion shall in no way relieve the Contractor of his obligations to secure the quality of the work and rate of progress required.
- B. Normal construction activity shall take place only between the hours of 6:30 a.m. to 4:00 p.m., excluding Saturdays, Sundays, and District holidays. Work outside the above time periods will be permitted only on an emergency basis and only with the approval of the Owner. Requests for work outside of normal hours shall be made at least two (2) business days in advance of the requested date.

1.02 OCCUPYING PRIVATE LAND:

- A. The Contractor shall not (except after written consent from the proper parties) enter or occupy with men, tools, materials, or equipment any land outside the rights of way or property of the Owner. A copy of the written consent shall be given to the Engineer.

1.03 PIPE LOCATIONS:

- A. Exterior pipelines will be located substantially as indicated on the Drawings, but the right is reserved to the Owner, acting through the Engineer, to make such modifications in location as may be found desirable to avoid interference with existing structures or for other reasons. Where fittings, etc., are noted on the Drawings, such notation is for the Contractor's convenience and does not relieve him from laying and jointing different or additional items where required.
- B. Small interior piping is indicated diagrammatically on the Drawings, and the exact location is to be determined in the field. Piping shall be arranged in a neat, compact, and workmanlike manner, with a minimum of crossing and interlacing, so as not to interfere with equipment or access ways, and, in general, without diagonal runs.

1.04 DIMENSION OF EXISTING STRUCTURES

- A. Where the dimensions and locations of existing structures are of importance in the installation or connection of any part of the Work, the Contractor shall verify such dimensions and locations in the field before the fabrication of any material or equipment which is dependent on the correctness of such information.

1.05 OPEN EXCAVATIONS:

- A. All open excavations shall be adequately safeguarded by providing temporary barricades, fencing, caution signs, lights, and other means to prevent accidents to persons and damage to property. The Contractor shall, at his own expense, provide suitable and safe bridges and other crossings for accommodating travel by pedestrians and workmen. Bridges provided for access during construction shall be removed when no longer required. The length or size of excavation will be controlled by the particular surrounding conditions, but shall always be confined to the limits prescribed by the Engineer. If the excavation becomes a hazard, or if it excessively restricts traffic at any point, the Engineer may require special construction procedures such as limiting the length of the open trench, prohibiting stacking excavated material in the street, and requiring that the trench shall not remain open overnight.
- B. The Contractor shall take precautions to prevent injury to the public due to open trenches. All trenches, excavated material, equipment, or other obstacles which could be dangerous to the public shall be well lighted at night.

1.06 TEST PITS:

- A. Test pits for the purpose of locating underground pipeline or structures in advance of the construction shall be excavated and backfilled by the Contractor at the direction of the Engineer. Test pits shall be backfilled immediately after their purpose has been satisfied and the surface restored and maintained in a manner satisfactory to the Engineer.

1.07 INTERFERENCE WITH AND PROTECTION OF STREETS:

- A. The Contractor shall not close or obstruct any portion of a street, road, or private way without obtaining permission from the proper authorities. If any street, road, or private way shall be rendered unsafe by the Contractor's operations, he shall make such repairs or provide such temporary ways or guards as shall be acceptable to the proper authorities.
- B. Streets, roads, private ways, and walks not closed shall be maintained passable and safe by the Contractor, who shall assume and have full responsibility for the adequacy and safety of provisions made therefor.
- C. The Contractor shall, at least forty-eight (48) hours in advance, notify the District in writing, with a copy to the Engineer, if the closure of a street or road is necessary. He

shall cooperate with the District in the establishment of alternate routes and shall provide adequate detour signs, plainly marked and well lighted, in order to minimize confusion.

1.08 CARE AND PROTECTION OF PROPERTY:

- A. The Contractor shall be responsible for the preservation of all public and private property, and shall use every precaution necessary to prevent damage thereto. If any direct or indirect damage is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the work on the part of the Contractor, such property shall be restored by the Contractor, at his expense, to a condition similar or equal to that existing before the damage was done, or he shall make good the damage in other manner acceptable to the Engineer.

1.09 PROTECTION AND RELOCATION OF EXISTING STRUCTURES AND UTILITIES:

- A. Contractor shall assume full responsibility for the protection of all buildings, structures, and utilities, public or private, including poles, signs, services to buildings, utilities in the street, gas pipes, water pipes, hydrants, sewers, drains, electric ductbanks, and telephone cables, whether or not they are shown on the Drawings. Contractor shall carefully support and protect all such structures and utilities from injury of any kind. Damage resulting from Contractor's operations shall be repaired by Contractor at his expense.
- B. Assistance will be given the Contractor in determining the location of existing services. The Contractor, however, shall bear full responsibility for obtaining all locations of underground structures and utilities (including existing water services, drain lines, and sewers). Services to buildings shall be maintained, and all costs or charges resulting from damage thereto shall be paid by the Contractor.
- C. Protection and temporary removal and replacement of existing utilities and structures as described in this Section shall be a part of the work under the Contract and all costs in connection therewith shall be included in the Bid.
- D. If, in the opinion of the Engineer, permanent relocation of a utility not shown is required, he may direct the Contractor, in writing, to perform the work. Work so ordered will be paid as extra work under Article 12 of the General Conditions. The Contractor shall fully cooperate with the District, and shall have no claim for delay due to such relocation.

1.10 INSPECTION OF WORK AWAY FROM THE SITE:

- A. If work to be done away from the construction site is to be inspected on behalf of the Owner during its fabrication, manufacture, or testing, or before shipment, the Contractor shall give notice to the Engineer of the place and time where such fabrication, manufacture, testing, or shipping is to be done. Such notice shall be in writing and delivered to the Engineer in ample time so that the necessary arrangements for the inspection(s) can be made.

1.11 COOPERATION WITHIN THIS CONTRACT:

- A. All firms or persons authorized to perform any work under this Contract shall cooperate with Contractor and his Subcontractors or trades, and shall assist in incorporating the work of other trades where necessary or required.
- B. Cutting and patching, drilling, and fitting shall be carried out where required by the trade or subcontractor having jurisdiction, unless otherwise indicated herein or directed by the Engineer.

1.12 CLEANUP AND DISPOSAL OF EXCESS MATERIAL:

- A. During the course of the work, the Contractor shall keep the site of his operations in as clean and as neat a condition as is possible. He shall dispose of all residue resulting from the construction work and, at the conclusion of the work, he shall remove and haul away any surplus excavation, concrete, broken pavement, lumber, equipment, temporary structures, and any other refuse remaining from the construction operations, and shall leave the entire site of the work in a neat and orderly condition.
- B. In order to prevent environmental pollution arising from the construction activities related to the performance of this Contract, the Contractor and his subcontractors shall comply with all applicable Federal, State, and local laws, and regulations concerning waste material disposal, as well as the specific requirements stated in this Section and elsewhere in the Specifications.

END OF SECTION

SECTION 01063

MISCELLANEOUS REQUIREMENTS

PART 1 - GENERAL

1.01 SCOPE OF WORK:

- A. The Contractor shall conform to all miscellaneous requirements as herein specified.

1.02 INTERFERENCE WITH EXISTING WORKS:

- A. The Contractor shall at all times conduct his operations so as to interfere as little as possible with existing works. The Contractor shall develop a program, in cooperation with the Engineer, which shall provide for the construction and putting into service of the new works in the most orderly manner possible. This program shall be adhered to except as deviations therefrom are expressly permitted. All work of connecting with, cutting into, and reconstructing existing pipes or structures shall be planned to interfere with the operation of the existing facilities for the shortest possible time, and such work shall be completed when the demands on the facilities best permit such interference, even though it may be necessary to work outside of normal working hours to meet these requirements.
- B. Before starting work which will interfere with the operation of existing facilities, the Contractor shall do all possible preparatory work and shall see that all tools, materials, and equipment are made ready and at hand.
- C. The Contractor shall make such minor modifications in the work relating to existing structures as may be necessary, without additional compensation.
- D. The Contractor shall have no claim for additional compensation by reason of delay or inconvenience in adapting his operations to meet the above requirements.
- E. The Contractor shall have no claim for additional compensation by reason of delay or inconvenience in adapting his operations to continuous treatment of sewage at the plant.

1.03 MAINTAINING FLOWS:

- A. It is essential to the operation of the existing sewerage system that there be no interruption in the flow of sewage. To this end, the Contractor shall at his own expense, provide, maintain, and operate all temporary facilities such as dams, pumping equipment, generators, conduits, and all other labor and equipment necessary to intercept the sewage flow before it reaches the points where it would interfere with his work, carry it past his work, and return it to the existing sewer below his work.

- B. The Contractor shall at his own cost, provide for the flow of sewers, drains and water courses interrupted during the progress of the work, and shall immediately cart away and remove all offensive matter. The entire procedure of maintaining existing flow shall be fully discussed with the Engineer well in advance of the interruption of any flow.
- C. Minimum sewage flow occurs during the night hours and the Contractor may work on the existing system at such times if he so chooses.
- D. The Contractor shall at his own expense, provide, maintain, and operate all temporary facilities such as dams, pumping equipment, generators, and all other labor and equipment necessary to prevent groundwater in the Final Clarifier Tanks from reaching the work. The water shall be pumped to adjacent tanks or tank drain vaults where it will not interfere with his work.

1.04 BURIED UTILITY WARNING AND IDENTIFICATION TAPE:

- A. Provide detectable aluminum foil plastic backed tape or detectable magnetic plastic tape manufactured specifically for warning and identification of buried piping. Tape shall be detectable by an electronic detection instrument. Provide tape in rolls, 3 inches minimum width, color coded for the utility involved with warning and identification imprinted in bold black letters continuously and repeatedly over entire tape length. Warning and identification shall be CAUTION BURIED WASTEWATER PIPING BELOW or similar. Use permanent code and letter coloring unaffected by moisture and other substances contained in trench backfill material. Bury tape with the printed side up at a depth of twelve-inches (12") below the top surface of earth or the top surface of the subgrade under pavements.

1.05 PROTECTION AGAINST ELECTROLYSIS:

- A. Where dissimilar metals are used in conjunction with each other, suitable insulation shall be provided between adjoining surfaces so as to eliminate direct contact and any resultant electrolysis. The insulation shall be bituminous impregnated felt, heavy bituminous coatings, nonmetallic separators or washers, or other acceptable materials.

END OF SECTION

SECTION 01300

SUBMITTALS

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. This Section specifies the general methods and requirements of submissions applicable to the following work-related submittals:
 - 1. Shop Drawings.
 - 2. Product Data.
 - 3. Samples.
 - 4. Mock Ups.
 - 5. Construction Photographs.
 - 6. Construction or Submittal Schedules.
 - 7. Operations & Maintenance Data.
- B. Detailed submittal requirements will be specified in the technical specifications section.

1.02 SHOP DRAWINGS, PRODUCT DATA, SAMPLES:

- A. Shop Drawings:
 - 1. Shop drawings, as defined in the General Conditions, and as specified in individual work Sections include, but are not necessarily limited to: custom-prepared data such as fabrication and erection/installation (working) drawings of concrete reinforcement, structural details and piping layout, scheduled information, setting diagrams, actual shopwork manufacturing instructions, custom templates, special wiring diagrams, coordination drawings, individual system or equipment inspection and test reports including performance curves and certifications as applicable to the work.
 - 2. All shop and working drawings shall be prepared on standard size, 24-in. by 36-in. sheets, except those which are made by changing existing standard shop or working drawings.
 - 3. All shop drawings shall be submitted using the transmittal form furnished by the Engineer.
 - 4. All shop drawings submitted by subcontractors for approval shall be sent directly to the Contractor for checking. The Contractor shall be responsible

for their submission at the proper time so as to prevent delays in delivery of materials.

5. The Contractor shall check all subcontractor's shop drawings regarding measurements, size of members, materials, and details to satisfy himself that they conform to the intent of the Drawings and Specifications. Shop drawings found to be inaccurate or otherwise in error shall be returned to the subcontractors for correction before submission thereof.
6. All details on shop drawings submitted for approval shall show clearly the relation of the various parts of the main members and lines of the structure, and where correct fabrication of the work depends upon field measurements, such measurements shall be made and noted on the drawings before being submitted for approval.
7. Submittals for equipment specified under Divisions 11, 13, 14, 15, and 16 shall include a listing of all installations where identical or similar equipment has been installed and been in operation for a period of at least one (1) year.
8. Submittals for equipment furnished under Divisions 11, 13, 14, 15, and 16 shall include maintenance and lubrication schedules for each piece of equipment. Schedules shall be similar to the following sample schedules:

Sample Maintenance Schedule

Item	Action	Frequency	Remarks
Sedimentation Equipment	Check removal of scum washdown; if required, remove any debris, etc.	Daily	
	Dewater, examine structure, scrape and paint all exposed walls of structure metals, examine scraping shoes.	6 months	Scrape and clean
	Sludge Collector Drive Unit	Remove shear pin, clean off rust, grease and replace	6 months
	Overflow weir	Check serviceability	Daily

Sample Lubrication Schedule

Item	Manufacturer's Recommendation	Type Lubricant	Frequency
Spur and Worm Gearing	Check oil level	See below; same as for oil change	Weekly
	Change oil	75-80 NSMP Gem oil (Winter); 80-90 NSMP Gem oil (Summer)	6 months
	Flush out drives before oil change	Kendall Flushing Oil	Prior to oil change
Gear Motors*	Change oil	Kenoil 053 R&O (Winter); Kenoil 072 R&O (Summer)	2,000 hours

* See manufacturer's instructional manual for initial operation instructions. (IMPORTANT)

B. Product Data:

1. Product data as specified in individual Sections, include, but are not necessarily limited to, standard prepared data for manufactured products (sometimes referred to as catalog data), such as the manufacturer's product specification and printed installation instructions, availability of colors and patterns, manufacturer's printed statements of compliances including certificates of compliance and applicability, roughing-in diagrams and templates, catalog cuts, product photographs, standard wiring diagrams, printed performance curves and operational-range diagrams, production or quality control inspection and test reports and certifications and recommended spare-parts listing, and printed product warranties, as applicable to the Work.

C. Samples:

1. Samples specified in individual Sections, include, but are not necessarily limited to, physical examples of the work such as sections of manufactured or fabricated work, small cuts or containers of materials, complete units of repetitively-used products, color/texture/pattern swatches and range sets, specimens for coordination of visual effect, graphic symbols, and units of work to be used by the Engineer or Owner for independent inspection and testing, as applicable to the Work.

1.03 CONTRACTOR'S RESPONSIBILITIES:

- A. The Contractor shall review shop drawings, product data, and samples, including those by subcontractors, prior to submission to determine and verify the following:
 1. Field measurements
 2. Field construction criteria
 3. Catalog numbers and similar data
 4. Conformance with the Specifications
- B. Each shop drawing, sample, and product data submitted by the Contractor shall have affixed to it the following Certification Statement including the Contractor's Company name and signed by the Contractor: "Certification Statement: by this submittal, I hereby represent that I have determined and verified all field measurements, field construction criteria, materials, dimensions, catalog numbers and similar data, and I have checked and coordinated each item with other applicable approved shop drawings and all Contract requirements." Shop drawings and product data sheets 11-in. X 17-in. and smaller shall be bound together in an orderly fashion and bear the above Certification Statement on the cover sheet. The cover sheet shall fully describe the packaged data and include a listing of all items within the package. Provide to the Engineer a copy of each submittal transmittal

form for shop drawings, product data, and samples at the time of submittal of said drawings, product data, and samples to the Engineer.

- C. If a shop drawing shows any deviation from the requirements of the Contract Documents, the Contractor shall make specific mention of the deviations in the Transmittal Form furnished and shall provide a description of the deviations in a letter attached to the submittal.
- D. The review and approval of shop drawings, samples, or product data by the Engineer shall not relieve the Contractor from his responsibility with regard to the fulfillment of the terms of the Contract. All risks of error and omission are assumed by the Contractor and the Engineer will not have responsibility therefor.
- E. No portion of the work requiring a shop drawing, sample, or product data shall be started nor shall any materials be fabricated or installed prior to the approval or qualified approval of such item. Fabrication performed, materials purchased, or on-site construction accomplished which does not conform to approved shop drawings and data shall be at the Contractor's risk. The Owner will not be liable for any expense or delay due to corrections or remedies required to accomplish conformity.
- F. Project work, materials, fabrication, and installation shall conform with approved shop drawings, applicable samples, and product data.
 - 1. Manufacturer's printed installation instructions, a part of product data submitted to the Engineer, will not be reviewed and are for informational purposes only.

1.04 SUBMISSION REQUIREMENTS:

- A. Make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the Work or in the work of any other contractor.
- B. All submittals shall be submitted sufficiently in advance of construction requirements to provide no less than ten business days, for review from the time received at the Engineer's reviewing office. For submittals of major equipment, that require more than ten days to review, due to its sheer complexity and amount of detail and also requiring review by more than one engineering discipline, a letter will be sent by the Project Manager or his/her designee to the Contractor informing him/her of the circumstances and the date it is expected the submittal will be returned to the Contractor.
- C. Number of submittals required:
 - 1. Shop Drawings and Product Data: Unless otherwise stated in the respective Specifications Sections, submit one (1) electronic file or three (3) paper copies. Prior to final pay request, the Contractor shall submit two (2) complete paper copies of each approved submittal.
 - 2. Samples: Submit the number stated in the respective Specification Sections (minimum of two).

D. Submittals shall contain:

1. The date of submission and the dates of any previous submissions.
2. The Project title and number.
3. Contractor identification.
4. The names of:
 - a. Contractor
 - b. Supplier
 - c. Manufacturer
5. Identification of the product, with the specification section number, page, and paragraph(s).
6. Field dimensions, clearly identified as such.
7. Relation to adjacent or critical features of the Work or materials.
8. Applicable standards, such as ASTM or Federal Specification numbers.
9. Identification of deviations from Contract Documents.
10. Identification of revisions on resubmittals.
11. An 8-in. X 3-in. blank space for Contractor and Engineer stamps.

E. Each shipment of drawings shall be accompanied by a transmittal form giving a list of the drawing numbers and the names mentioned above, along with the project information.

1.05 REVIEW OF SHOP DRAWINGS, PRODUCT DATA, WORKING DRAWINGS, AND SAMPLES:

- A. The Engineer's review is for general conformance with the design concept and contract drawings. Markings or comments shall not be construed as relieving the Contractor from compliance with the contract plans and specifications or from departures therefrom. The Contractor remains responsible for details and accuracy, for coordinating the work with all other associated work and trades, for selecting fabrication processes, for techniques of assembly, and for performing work in a safe manner.
- B. The review of shop drawings, data, and samples will be general. They shall not be construed:
 1. as permitting any departure from the Contract requirements;
 2. as relieving the Contractor of responsibility for any errors, including details, dimensions, and materials;
 3. as approving departures from details furnished by the Engineer, except as otherwise provided herein.

- C. If the shop drawings, data, or samples as submitted describe variations and show a departure from the Contract requirements which the Engineer finds to be in the interest of the Owner and to be so minor as not to involve a change in Contract Price or time for performance, the Engineer may return the reviewed drawings without noting an exception.
- D. One (1) copy of shop drawings or product data will be returned to the Contractor via email or First Class United States Postal Service if paper copies are submitted. Samples will not be returned.
- E. Submittals will be returned to the Contractor under one (1) of the action codes indicated and defined on the transmittal form furnished by the Engineer.
- F. Resubmittals will be handled in the same manner as first submittals. On resubmittals the Contractor shall direct specific attention, in writing, on the letter of transmittal and on resubmitted shop drawings by use of revision triangles or other similar methods, to revisions other than the corrections requested by the Engineer, on previous submissions. Any such revisions which are not clearly identified shall be made at the risk of the Contractor. The Contractor shall make corrections to any work done because of this type revision that is not in accordance to the Contract Documents as may be required by the Engineer.
- G. Partial submittals may not be reviewed. The Engineer will be the only judge as to the completeness of a submittal. Submittals not complete will be returned to the Contractor, and will be considered "Rejected" until resubmitted. The Engineer may at his option provide a list or mark the submittal directing the Contractor to the areas that are incomplete.
- H. If the Contractor considers any correction indicated on the shop drawings to constitute a change to the Contract Documents, the Contractor shall give written notice thereof to the Engineer at least seven (7) working days prior to release for manufacture.
- I. When the shop drawings have been completed to the satisfaction of the Engineer, the Contractor shall carry out the construction in accordance therewith and shall make no further changes therein except upon written instructions from the Engineer.

1.06 DISTRIBUTION:

- A. Distribute reproductions of approved shop drawings and copies of approved product data and samples, where required, to the job site file and elsewhere as directed by the Engineer.

1.07 GENERAL PROCEDURES FOR SUBMITTALS:

- A. Coordination of Submittal Times: Prepare and transmit each submittal sufficiently in advance of performing the related work or other applicable activities, or within the time specified in the individual work sections, of the Specifications, so that the

installation will not be delayed by processing times including disapproval resubmittal (if required), coordination with other submittals, inspection, testing (off-site and on-site), purchasing, fabrication, delivery and similar sequenced activities. No extension of time will be authorized because of the Contractor's failure to transmit submittals sufficiently in advance of the Work.

1.08 OPERATING AND MAINTENANCE INSTRUCTIONS AND PARTS LISTS:

A. Where reference is made in the Detail Technical Specifications to operating and maintenance and spare parts lists, the Contractor shall furnish for each piece of equipment four (4) complete sets giving the information listed below.

1. The manual for each piece of equipment shall be a separate document with the following specific requirements:

a. Contents:

- (1) Table of contents and index
- (2) Brief description of each system and components
- (3) Starting and stopping procedures
- (4) Special operating instructions
- (5) Routine maintenance procedures
- (6) Clean and concise manufacturer's printed operating and maintenance instructions, adjustment, lubrication, and other maintenance of equipment including: parts list, illustrations, and diagrams
- (7) One (1) copy of each wiring diagram
- (8) One (1) copy of each approved shop drawing and each Contractor's coordination and layout drawing
- (9) List of spare parts, manufacturer's price, and recommended quantity
- (10) Name, address, and telephone numbers of local service representatives

b. Material:

- (1) Loose leaf on 60 pound, punched paper
- (2) Holes reinforced with plastic cloth or metal
- (3) Page size, 8-1/2-in. by 11-in.
- (4) Diagrams, illustrations, and attached foldouts as required of original quality
- (5) Covers: oil, moisture, and wear resistant 9 X 12 size

- B. Such instructions and parts lists shall be completely and neatly annotated so that only the specific equipment and features furnished are clearly indicated. References to other sizes and types or models of similar equipment shall be deleted or neatly lined out.
- C. Such instructions and parts lists shall be delivered to the Engineer at the same time that the equipment to which they pertain is delivered to the site. Each submittal shall be accompanied by a transmittal form identifying the information included. Each submittal shall be reviewed by the Engineer for compliance with the above requirements.
- D. If a submittal is acceptable, all four copies will be retained by the Engineer. If deficiencies are found, one copy will be retained by the Engineer and three copies with the deficiencies, noted, will be returned to the Contractor. The copy retained by the Engineer shall not count toward the four complete acceptable sets required herein.
- E. At the Engineer's discretion, he may retain all four copies and request only supplemental information from the Contractor.

1.09 CONTENTS, EACH VOLUME:

- A. Table of Contents: Provide title of Project, names, addresses, and telephone numbers of Engineer, subconsultants, and Contractor with name of responsible parties; schedule of products and systems, indexed to content of the volume.
- B. For Each Product or System: List names, addresses and telephone number of Subcontractors and suppliers; including local source of supplies and replacement parts.
- C. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- D. A list of all parts for the equipment with each part identified by a functional name, the part manufacturer's name, and a unique part number (normally the part manufacturer's alpha-numeric designation). A list of parts keyed by non-unique item numbers to a sectional drawing will not be adequate to fulfill this requirement.
- E. All components of each system, e.g., pump motor, coupling, and drive, shall be combined in a single submittal with the above data provided for each component.
- F. Drawings: Supplement product data to illustrate relations of component parts, and data applicable to installation. Delete inapplicable information.
- G. Type Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's printed instructions specified.
- H. Warranties and Bonds.

1.10 MANUAL FOR EQUIPMENT AND SYSTEMS:

- A. For each Item of Equipment and Each System provide the following:
1. Description of unit or system, and component parts. Identify function, normal operating characteristics, and limiting conditions. Include certified performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
 2. Panelboard Circuit Directories including electrical service characteristics, controls and communications, and color coded wiring diagrams as installed.
 3. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences; regulation, control, stopping, shut-down, and emergency instructions; and summer, winter, and any special operating instructions.
 4. Maintenance Requirements:
 - a. Route procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
 - b. Servicing and lubrication schedule, with list of lubricant type, frequency, and method of lubrication. Any components which do not require lubrication or any expendable components which are not normally serviced shall be clearly noted as such.
 - c. Manufacturer's printed operation and maintenance instructions.
 - d. Sequence of operation by controls manufacturer.
 - e. Original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
 - f. Lubrication and maintenance schedules shall be similar to that specified in Section 01300.
 5. Control diagrams by controls manufacturer as installed.
 6. Contractor's coordination drawings, with color coded piping diagrams as installed.
 7. Charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
 8. List of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
 9. Test and balancing reports as specified.
 10. Additional Requirements: As specified in individual specification sections.
- B. Provide a listing in Table of Contents for design data, if provided by Contractor, with tabbed fly sheet and space for insertion of data.

1.11 INSTRUCTION OF OWNER PERSONNEL:

- A. Before final inspection, instruct Owner's designated personnel in operation, adjustment, and maintenance of products, equipment, and systems, at agreed upon times. Where specified in technical Specification Sections for specific equipment or systems, the Contractor shall have instructions video-taped while they are being given to Owner's personnel. Video-taping shall be performed by a person or organization experienced in the production of tapes and shall include the entire instruction session(s) and all questions and answers. Tapes shall become the property of the Owner.
- B. Use operation and maintenance manuals as basis for instruction. Review contents of manual with personnel in detail to explain aspects of operation and maintenance.
- C. Prepare and insert additional data in Operations and Maintenance Manual when need for such data becomes apparent during instruction.
- D. Provide a completed and filled-out Equipment Manufacturer's Certificate of Installation, Testing, and Instruction form attached to the end of this section.

1.12 SERVICES OF MANUFACTURER'S REPRESENTATIVE:

- A. The Contractor shall arrange for a qualified service representative from each company manufacturing or supplying equipment, as indicated in the specifications.
- B. After installation of the equipment has been completed and the equipment is presumably ready for operation, but before it is operated by others, the representative shall inspect, operate, test, and adjust the equipment. The inspection shall include but shall not be limited to, the following points as applicable:
 - 1. Soundness (without cracked or otherwise damaged parts).
 - 2. Completeness in all details, as specified.
 - 3. Correctness of setting, alignment, and relative arrangement of various parts.
 - 4. Adequacy and correctness of packing, sealing, and lubricants.
- C. The operation, testing, and adjustment shall be as required to prove the equipment is left in proper condition for satisfactory operation under the conditions specified.
- D. On completion of his work, the manufacturer's or supplier's representative shall submit in triplicate to the Engineer a complete signed report of the result of his inspection, operation, adjustments, and tests. The report shall include detailed descriptions of the points inspected, tests and adjustments made, quantitative results obtained if such are specified, and suggestions for precautions to be taken to ensure proper maintenance. The report also shall include a Certificate of Unit Responsibility stating that the equipment conforms to the requirements of the Contract and is ready for permanent operation and that nothing in the installation will render the manufacturer's warranty null and void.
- E. Refer and conform to the additional requirements specified in Section 01400.

1.13 NAMEPLATES:

- A. With the exceptions mentioned below, each piece of equipment shall be provided with a substantial nameplate of non-corrodible metal, securely fastened in place and clearly and permanently inscribed with the manufacturer's name, model or type designation, serial number, principal rated capacities, electrical or other power characteristics, and similar information as appropriate.
- B. This requirement shall not apply to standard, manually operated hydrants or to gate, globe, check, and plug valves.
- C. Each process valve shall be provided with a substantial tag of non-corrodible metal securely fastened in place and inscribed with an identification number in conformance with the valve identification indicated on the drawings or furnished later by the Engineer.

1.14 LUBRICANTS:

- A. During testing and prior to acceptance, the Contractor shall furnish all lubricants necessary for the proper lubrication of all equipment furnished under this contract.

1.15 SPECIAL TOOLS:

- A. For each type of equipment furnished by him, the Contractor shall provide a complete set of all special tools (including grease guns or other lubricating devices) which may be necessary for the adjustment, operation, maintenance, and disassembly of such equipment. Tools shall be high-grade, smooth, forged, alloy, tool steel. Grease guns shall be lever type.
- B. Special tools are considered to be those tools which because of their limited use are not normally available, but which are necessary for the particular equipment.
- C. Special tools shall be delivered at the same time as the equipment to which they pertain. The Contractor shall properly store and safeguard such special tools until completion of the work, at which time they shall be delivered to the Owner.

1.16 CERTIFICATION FORMS:

- A. If specifically specified in other Sections of these Specifications, the Contractor shall submit the applicable certification form for each item required, and in the form attached to this Section, completely filled in and stamped.

1.17 CERTIFICATES OF COMPLIANCE:

- A. Certificates of Compliance specified in the specifications shall include and mean certificates, manufacturer's certificates, certifications, certified copies, letters of certification, and certificate of materials.
- B. The Contractor shall be responsible for providing Certificates of Compliance requested and specified in the technical specifications. Certificates are required for demonstrating proof of compliance with specification requirements and shall be executed in three (3) copies unless otherwise specified. Each certificate shall be

signed by an official authorized to certify on behalf of the manufacturing company and shall contain the name and address of the Supplier, the project name and location, and the quantity and date or dates of shipment or delivery to which the certificates apply.

- C. Copies of laboratory test reports submitted with certificates shall contain the name and address of the testing laboratory and the date or dates of the tests to which the report applies. Certification shall not be construed as relieving the Supplier from furnishing satisfactory material, if after tests are performed on selected samples, the material is found not to meet the specific requirements.

END OF SECTION

Not to be used for bidding purposes

CERTIFICATE OF DESIGN

The undersigned hereby certifies that he/she is a Professional Engineer registered in the state of _____ and that he/she has been employed by (Name of Contractor) _____ to design _____ in accordance with Specifications Section _____ for the (Name of Project) _____. The undersigned further certifies that he/she has performed similar designs previously and has performed the design of the _____; that said design is in conformance with all applicable local, state, and federal codes, rules, and regulations and professional practice standards; that his/her signature and Professional Engineer (PE) Stamp have been affixed to all calculations and drawings used in, and resulting from, the design; and that the use of that stamp signifies the responsibility of the undersigned for that design.

The undersigned hereby certifies that he/she has Professional Liability Insurance with limits of \$1,000,000.00 and a Certificate of Insurance is attached.

The undersigned hereby agrees to make all original design drawings and calculations available to the Rock River Water Reclamation District or Owner's representative within seven (7) days following written request therefore by the Owner.

PE Name

Contractor's Name

Signature

Signature

Title

Title

Address

Address

City, State Zip Code

City, State Zip Code

CERTIFICATE OF UNIT RESPONSIBILITY
For Specification Section _____

(Section title)

In accordance with Section 01300, paragraph 1.12 of the contract documents, the undersigned manufacturer accepts unit responsibility for all components of equipment furnished under specification Section _____ and the requirements specified herein. We hereby certify that these components are compatible and comprise a functional unit suitable for the specified and indicated performance and design requirements.

Not to be used for bidding purposes

EQUIPMENT MANUFACTURER'S CERTIFICATE OF INSTALLATION,
TESTING, AND INSTRUCTION

Owner - _____
(fill in)

Project - _____
(fill in description)

Contract No. _____
(fill in)

M&E No. _____

EQUIPMENT SPECIFICATION SECTION _____

EQUIPMENT DESCRIPTION _____

I _____, Authorized representative of
(Print Name)

(Print Manufacturer's Name)

hereby CERTIFY that _____
(Print equipment name and model with serial No.)

installed for the subject project (has) (have) been installed in a satisfactory manner, (has)
(have) been satisfactorily tested, (is) (are) ready for operation, and that Owner assigned
operating personnel have been suitably instructed in the operation, lubrication, and care of
the unit(s) on

Date: _____ Time: _____

Certified By: _____ Date: _____
(Signature of Manufacturer's Representative)

OWNER'S ACKNOWLEDGMENT OF MANUFACTURER'S INSTRUCTION

(I) (We) the undersigned, authorized representatives of the _____
_____ and/or Plant Operating Personnel have received classroom and hands-on
instruction on the operation, lubrication, and maintenance of the subject equipment and
(am) (are) prepared to assume normal operational responsibility for the equipment:

_____ Date: _____

_____ Date: _____

_____ Date: _____

Notary Public

Name of Corporation

Commission expiration date

Address

Seal: By: _____
Duly Authorized Official

Legal Title of Official

Date: _____

Not to be used for bidding purposes

SECTION 01400

QUALITY ASSURANCE

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. This section covers Quality Assurance and Control requirements for this contract.
- B. The Contractor is responsible for controlling the quality of work, including work of its subcontractors and suppliers and for assuring that the quality specified in the Specifications is achieved.
- C. Refer to the General Provisions.

1.02 TESTING LABORATORY SERVICES:

- A. All tests which require the services of a laboratory to determine mix designs and verify initial compliance with the Contract Documents, shall be performed by an independent commercial testing laboratory acceptable to the Engineer. The laboratory shall be staffed with experienced technicians, properly equipped, and fully qualified to perform the tests in accordance with the specified standards.
- B. Preliminary Testing Services: Unless otherwise specified, the Contractor shall be responsible for all initial testing laboratory services in connection with concrete materials and mix designs, the design of asphalt mixtures, gradation tests for structural and embankment fills, backfill materials, and all other initial tests and engineering data required for the Engineer's review of materials and equipment proposed to be used in the Work. The Contractor shall obtain the Engineer's acceptance of the testing laboratory before having services performed, and shall pay all costs for services.
- C. Quality Control Testing Services: The District will perform all quality control tests in the field or in the laboratory on materials being placed into the work such as concrete, asphalt mixtures, moisture-density (Proctor) and gradation tests on structural and embankment fills, and backfill materials, in-place field density tests on structural and embankment fills, and other materials and equipment, during and after their incorporation in the Work. Field sampling and testing shall be performed in the general manner indicated in the specifications, with minimum interference with construction operations. The Engineer shall determine the exact time and location of field sampling and testing, and may require such additional sampling and testing as necessary to determine that materials and equipment conform with data previously furnished by the Contractor and conform with the Contract Documents.

- D. Delivery of samples and test specimens to the testing laboratory will be made by the testing agency. The laboratory tests shall be performed within a reasonable time consistent with the specified standards. Furnish a written report of each test to the Engineer.
- E. Contractor shall furnish all sample materials and cooperate in the sampling and field testing activities, interrupting the Work when necessary. When sampling or testing activities are performed in the field, the Contractor shall furnish personnel and facilities to assist in the activities.
- F. The Contractor shall not retain any testing laboratory against which the Owner or the Engineer have reasonable objection, and if at any time during the construction process the services become unacceptable to the Owner, or the Engineer, either the Owner or the Engineer may direct in writing that such services be terminated. The request must be supported with evidence of improper testing or unreasonable delay. If the Engineer determines that sufficient cause exists, the Contractor shall terminate the services and engage a different testing laboratory.
- G. Transmittal of Test Reports: Written reports of testing and engineering data furnished by the Contractor for the Engineer's review of materials and equipment proposed to be used in the Work shall be submitted as specified for Shop Drawings.
- H. The testing laboratory shall electronically furnish a written report of each test performed by laboratory personnel in the field or laboratory. Test reports shall be submitted to the Engineer's Representative, the Owner, and the Contractor within a reasonable time after each test is completed.

1.03 QUALITY ASSURANCE:

- A. Codes and Standards: Refer to individual specification sections and the General Provisions.
- B. Copies of applicable referenced standards are not included in the Contract Documents. Where copies of standards are needed by the Contractor for superintendence and quality control of the work, the Contractor shall obtain a copy or copies directly from the publication source and maintain at the jobsite, available to the Contractor's personnel, subcontractors, and Engineer
- C. Quality of Materials: Unless otherwise specified, all materials and equipment furnished for permanent installation in the Work shall conform to applicable standards and specifications and shall be new, unused, and free from defects and imperfections, when installed or otherwise incorporated in the Work. Material and equipment shall not be used by the Contractor for any purpose other than that intended or specified unless such use is authorized by the Engineer.

- D. Where so specified, products or workmanship shall also conform to the additional performance requirements included within the Contract Documents to establish a higher or more stringent standard or quality than that required by the referenced standard.

1.04 OFFSITE INSPECTION:

- A. When the specifications require inspection of materials or equipment during the production, manufacturing, or fabricating process, or before shipment, such services shall be performed by an independent testing laboratory, or inspection organization acceptable to Engineer in conjunction with or by the Engineer.
- B. The Contractor shall give appropriate written notice to the Engineer not less than 30 days before offsite inspection services are required, and shall provide for the producer, manufacturer, or fabricator to furnish safe access and proper facilities and to cooperate with inspecting personnel in the performance of their duties.
- C. The inspection organization shall submit a written report to the Contractor who shall provide copies to the Engineer.

1.05 MATERIALS AND EQUIPMENT:

- A. The Contractor shall maintain control over procurement sources to ensure that materials and equipment conform to specified requirements in the Contract Documents.
- B. The Contractor shall comply with manufacturer's printed instructions regarding all facets of materials and/or equipment movement, storage, installation, testing, startup, and operation. Should circumstances occur where the contract documents are more stringent than the manufacturer's printed instructions, Contractor shall comply with the specifications. In cases where the manufacturer's printed instructions are more stringent than contract documents, Contractor shall advise Engineer of the disparity and conform to manufacturer's printed instructions. In either case, Contractor is to apply the more stringent specification or recommendation, unless approved otherwise by the Engineer.

1.06 SHOP AND FIELD TESTING:

- A. The Contractor is responsible for providing the shop and field testing specified in the technical specification sections.
- B. The Contractor and its Subcontractor shall perform inspections, tests, and other services as required by the Contract Documents.
- C. Contractor shall provide twenty-one days of notice to the Engineer so that the Engineer may witness Contractor and/or Subcontractors off site and on site tests. The Engineer's witnessing of tests does not relieve the Contractor and/or Subcontractors of their obligation to comply with the requirements of the Contract Documents.

1.07 MANUFACTURER'S FIELD SERVICES:

- A. When specified in the technical specifications sections, the Contractor shall arrange for and provide technical representation from the manufacturer of respective equipment, items, or components. The manufacturer's representative shall be a factory trained service engineer/technician with the type and length of experience specified in the technical specifications.
- B. Services Furnished Under This Contract: An experienced, competent, and authorized factory trained service engineer/technician representative of the manufacturer of each item of equipment for which field services are indicated in the specifications shall visit the site of the Work and inspect, operate, test, check, adjust if necessary, and approve the equipment installation. In each case, the manufacturer's service representative shall be present when the equipment is placed in operation. The manufacturer's service representative shall revisit the jobsite as often as necessary until all problems are corrected and the equipment installation and operation are satisfactory to the Engineer.
- C. Refer to Section 01300 - Operations and Maintenance Data, for additional requirements.

1.08 CERTIFICATION FORMS AND CERTIFICATES:

- A. The Contractor shall be responsible for submitting the certification forms and certificates in conformance with the requirements specified in Section 01300 - Submittals.

PART 2 - PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 QUALITY CONTROL:

- A. Quality control is the responsibility of the Contractor, and the Contractor shall maintain control over construction and installation processes to assure compliance with specified requirements.
- B. Certifications for personnel, procedures, and equipment associated with special processes (e.g., welding, cable splicing, instrument calibration, surveying) shall be maintained in the Contractor's field office, available for inspection by the Engineer. Copies will be made available to the Engineer upon request.
- C. Means and methods of construction and installation processes are the responsibility of the Contractor, and at no time is it the intent of the Engineer to supersede or void that responsibility.

END OF SECTION

SECTION 01500

TEMPORARY FACILITIES

PART 1 - GENERAL

1.01 SCOPE OF WORK:

- A. The Contractor shall provide all temporary facilities for the proper completion of the work, as required and as specified.

1.02 SANITARY REGULATIONS:

- A. The Contractor shall provide adequate sanitary facilities, toilets and wash stations, for the use of those employed on the Work. Such facilities shall be made available when the first employees arrive on the site of the Work, shall be properly secluded from public observation, shall be constructed and maintained during the progress of the Work, and shall remain on site in suitable numbers and at such points and in such manner as may be required until all work is completed.
- B. Owner facilities shall not be used by the Contractor, his sub-contractors, or suppliers. The Contractor shall maintain the sanitary facilities in a satisfactory and sanitary condition at all times and shall enforce their use. He shall rigorously prohibit the committing of nuisances on the site of the Work, on the lands of the Owner, or on adjacent property.

1.03 WATER SUPPLY:

- A. The Contractor shall make arrangements and pay for all water necessary for completion of construction operations under this contract.

1.04 TEMPORARY HEAT:

- A. If temporary heat is required for the protection of the Work from freezing conditions, the Contractor shall provide and install suitable heating apparatus, shall provide adequate and proper fuel, and shall maintain heat as required. Temporary heat at Contractor's expense.

1.05 ELECTRICAL ENERGY:

- A. The Contractor shall make all necessary arrangements with the Owner for 480-volt power and pay all fees and charges for electrical energy for power and light necessary for the proper completion of the Work, for Contractor's site trailer, and during project's entire progress. The Contractor shall provide and pay for all temporary transformers, wiring, switches, connections, and meters.
- B. The Contractor shall provide portable generators for their dewatering equipment.

- C. Convenience receptacles, 120-volt single phase power, are limited in availability in the area of this work and Contractor shall provide generators as necessary for their use. Use of convenience receptacles for dewatering pumps is prohibited.
- D. The Contractor shall provide sufficient electric lighting so that all work may be done in a workmanlike manner when there is not sufficient daylight.

1.06 PRECAUTIONS DURING ADVERSE WEATHER:

- A. During adverse weather and against the possibility thereof, the Contractor shall take all necessary precautions so that the Work may be properly done and satisfactory in all respects. When required, protection shall be provided by use of tarpaulins, wood and building-paper shelters, or other suitable means.
- B. During cold weather, materials shall be preheated, if required, and the materials and adjacent structure into which they are to be incorporated shall be made and kept sufficiently warm so that a proper bond will take place and a proper curing, aging, or drying will result. Protected spaces shall be artificially heated by suitable means which will result in a moist or a dry atmosphere according to the particular requirements of the work being protected. Ingredients for concrete and mortar shall be sufficiently heated so that the mixture will be warm throughout when used.
- C. When exposed during the work, piping systems shall be protected by the Contractor from freezing under all potential cold weather conditions.

1.07 CONTRACTOR'S FIELD OFFICE:

- A. The Contractor shall maintain a temporary field office near the work for his own use during the period of construction. The office shall be located in the area designated on the drawings and where it will not interfere with the progress of the work.
- B. The Contractor shall provide office space and facilities for Contractor's staff, site records, and to accommodate progress meetings. No District building space is available for the Contractor's use.
- C. Unless otherwise directed by the Engineer, after the date of completion of the Work, the Contractor shall remove the office and all such temporary facilities from the site, the same to become his property, and leave the premises in a condition acceptable to the Engineer.

END OF SECTION

SECTION 01600

CONTROL OF MATERIALS

PART 1 - GENERAL

1.01 APPROVAL OF MATERIALS:

- A. Unless otherwise specified, only new materials and equipment shall be incorporated in the work. All materials and equipment furnished by the Contractor shall be subject to the inspection and approval of the Engineer. No material shall be delivered to the work site without prior approval of the Engineer.
- B. As specified in Section 01300, the Contractor shall submit to the Engineer, data relating to materials and equipment he proposes to furnish for the work. Such data shall be in sufficient detail to enable the Engineer to identify the particular product and to form an opinion as to its conformity to the specifications.
- C. Facilities and labor for handling and inspection of all materials and equipment shall be furnished by the Contractor. If the Engineer requires, either prior to beginning or during the progress of the work, the Contractor shall submit additional samples or materials for such special tests as may be necessary to demonstrate that they conform to the specifications. Such samples shall be furnished, stored, packed, and shipped as directed at the Contractor's expense. Except as otherwise noted, the Owner will make arrangements for and pay for the tests.
- D. Any delay of approval resulting from the Contractor's failure to submit samples or data promptly shall not be used as a basis of a claim against the Owner.
- E. In order to demonstrate the proficiency of workmen or to facilitate the choice among several textures, types, finishes, and surfaces, the Contractor shall provide such samples of workmanship or finish as may be required.
- F. The materials and equipment used on the work shall correspond to the approved samples or other data.

1.02 BOLTS, ANCHOR BOLTS, AND NUTS:

- A. All necessary bolts, anchor bolts, nuts, washers, plates, and bolt sleeves shall be furnished by the Contractor in accordance herewith. Anchor bolts shall have suitable washers and, where so required, their nuts shall be hexagonal.

- B. All anchor bolts, nuts, washers, plates, and bolt sleeves shall be Type 316 stainless steel, except where otherwise specifically indicated.
- C. Where non-stainless steel hardware is indicated as acceptable, the hardware shall conform to the following as appropriate.
1. Expansion bolts shall have malleable iron and lead composition elements of the required number of units and size.
 2. Unless otherwise specified, stud, tap, and machine bolts, and nuts shall conform to the requirements of ASTM Standard Specification for Carbon Steel Externally and Internally Threaded Standard Fasteners, Designation A307. Hexagonal nuts of the same quality of metal as the bolts shall be used. All threads shall be clean cut and shall conform to AN Standard B1.1 for Unified Inch Screw Threads (UN and UNR Thread Form).
 3. Bolts, anchor bolts, nuts, and washers, specified to be galvanized, shall be zinc coated, after being threaded, by the hot-dip process in conformity with the ASTM Standard Specification for Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strip, Designation A123, or the ASTM Standard Specifications for Zinc Coating (Hot Dip) on Iron and Steel Hardware, Designation A153, as is appropriate.
- D. Anchor bolts and expansion bolts shall be set accurately. If anchor bolts are set before the concrete has been placed, they shall be carefully held in suitable templates of acceptable design. Where indicated on the Drawings, specified, or required, anchor bolts shall be provided with square plates at least 4 in. by 4 in. by 3/8 in. or shall have square heads and washers and be set in the concrete forms with suitable pipe sleeves, or both. If anchor or expansion bolts are set after the concrete has been placed, all necessary drilling and grouting or caulking shall be done by the Contractor and care shall be taken not to damage the structure or finish by cracking, chipping, spalling, or otherwise during the drilling and caulking.

1.03 GREASE FITTINGS:

- A. Provide extension fittings and tubing on all grease fittings that are installed in an inaccessible location. The extension is to be located so that equipment can be lubricated from the operating level without the use of ladders, staging, or shutting down the equipment. Tubing for grease shall be Type 316 stainless steel.

1.04 CONCRETE INSERTS:

- A. Concrete inserts for hangers shall be designed to support safely, in the concrete that is used, the maximum load that can be imposed by the hangers used in the inserts. Inserts for hangers shall be of a type which will permit adjustment of the hangers both horizontally (in one plane) and vertically and locking of the hanger head or nut. All inserts shall be Type 316 stainless steel.

1.05 SLEEVES:

- A. Unless otherwise indicated on the Drawings or specified, openings for the passage of pipes through floors and walls shall be formed of sleeves of standard-weight, galvanized-steel pipe. The sleeves shall be of ample diameter to pass the pipe and its insulation, if any, and to permit such expansion as may occur. Sleeves shall be of sufficient length to be flush at the walls and the bottom of slabs and to project 1 in. above the finished floor surface. Threaded nipples shall not be used as sleeves.
- B. Sleeves in exterior walls below ground or in walls to have liquids on one or both sides shall have a 2-in. annular fin of 1/8-in. plate welded with a continuous weld completely around the sleeve at about mid-length. Sleeves shall be galvanized after the fins are attached.
- C. All sleeves shall be set accurately before the concrete is placed or shall be built in accurately as the masonry is being built.
- D. Pipes passing through sleeves below ground or in water containing structures shall be sealed using double link seals. Seal bolts shall be accessible from inside of the structure.

1.06 FOUNDATIONS, INSTALLATION AND GROUTING:

- A. The Contractor shall furnish the necessary materials and construct suitable concrete foundations for all equipment installed by him, even though such foundations may not be indicated on the Drawings. The tops of foundations shall be at such elevations as will permit grouting as specified below.
- B. All such equipment shall be installed by skilled mechanics and in accordance with the instructions of the manufacturer.
- C. In setting pumps, motors, and other items of equipment customarily grouted, the Contractor shall make an allowance of at least 1 in. for grout under the equipment bases. Shims used to level and adjust the bases shall be steel. Shims may be left embedded in the grout, in which case they shall be installed neatly and so as to be as inconspicuous as possible in the completed work. Unless otherwise permitted, all grout shall be a suitable nonshrinking grout.
- D. Grout shall be mixed and placed in accordance with the recommendations of the manufacturer. Where practicable, the grout shall be placed through the grout holes in the base and worked outward and under the edges of the base and across the rough top of the concrete foundation to a peripheral form so constructed as to provide a suitable chamfer around the top edge of the finished foundation.
- E. Where such procedure is impracticable, the method of placing grout shall be as permitted. After the grout has hardened sufficiently, all forms, hoppers, and excess grout shall be removed, and all exposed grout surfaces shall be patched in an approved manner, if

necessary, given a burlap-rubbed finish, and painted with at least two coats of an acceptable paint.

1.07 EQUIPMENT DRIVE GUARDS:

- A. All equipment driven by open shafts, belts, chains, or gears shall be provided with acceptable all-metal guards enclosing the drive mechanism. Guards shall be constructed of galvanized sheet steel or galvanized woven wire or expanded metal set in a frame of galvanized steel members. Guards shall be secured in position by steel braces or straps which will permit easy removal for servicing the equipment. The guards shall conform in all respects to all applicable safety codes and regulations.

END OF SECTION

Not to be used for bidding purposes

SECTION 01610

DELIVERY, STORAGE, AND HANDLING

PART 1 - GENERAL

1.01 GENERAL:

- A. This Section specifies the general requirements for the delivery, handling, storage, and protection for all items required in the construction of the work. Specific requirements, if any, are specified with the related item.

1.02 TRANSPORTATION AND DELIVERY:

- A. Transport and handle items in accordance with manufacturer's instructions.
- B. Schedule delivery to reduce long term on-site storage prior to installation and/or operation. Under no circumstances shall equipment be delivered to the site more than one month prior to installation without written authorization from the Engineer.
- C. All deliveries shall be to the Contractor storage area. Contractor deliveries shall not be made to District's receiving department.
- D. Coordinate delivery with installation to ensure minimum holding time for items that are hazardous, flammable, easily damaged, or sensitive to deterioration.
- E. Deliver products to site in manufacturer's sealed containers or other packing systems, complete with instructions for handling, storing, unpacking, protecting, and installing.
- F. All items delivered to the site shall be unloaded and placed in a manner which will not hamper the Contractor's normal construction operation or those of subcontractors and Owner and other contractors and will not interfere with the flow of necessary traffic.
- G. Provide necessary equipment and personnel to unload all items delivered to the site.
- H. Promptly inspect shipment to assure that products comply with requirements, quantities are correct, and items are undamaged. For items furnished by others (i.e. Owner, other Contractors), perform inspection in the presence of the Engineer. Notify Engineer verbally, and in writing, of any problems.

1.03 STORAGE AND PROTECTION:

- A. Store and protect products in accordance with the manufacturer's instructions, with seals and labels intact and legible. Storage instruction shall be studied by the Contractor and

reviewed with the engineer. Instruction shall be carefully followed and a written record of this kept by the Contractor. Arrange storage to permit access for inspection.

- B. Store loose granular materials on solid flat surface in a well-drained area. Prevent mixing with foreign matter.
- C. Cement and lime shall be stored under a roof and off the ground and shall be kept completely dry at all times. All structural, miscellaneous, and reinforcing steel shall be stored off the ground or otherwise to prevent accumulation of dirt or grease, and in a position to prevent accumulations of standing water and to minimize rusting. Beams shall be stored with the webs vertical. Precast concrete shall be handled and stored in a manner to prevent accumulations of dirt, standing water, staining, chipping, or cracking. Brick, block, and similar masonry products shall be handled and stored in a manner to reduce breakage, cracking, and spalling.
- D. All mechanical and electrical equipment and instruments subject to corrosive damage by the atmosphere shall be stored in a weather-tight building to prevent injury. The building may be a temporary structure on the site or elsewhere, but it must be satisfactory to the Engineer. Building shall be provided with adequate ventilation to prevent condensation. Maintain temperature and humidity within range required by manufacturer.
 - 1. All equipment shall be stored fully lubricated with oil, grease, and other lubricants unless otherwise instructed by the manufacturer.
 - 2. Moving parts shall be rotated a minimum of once weekly to insure proper lubrication and to avoid metal-to-metal "welding". Upon installation of the equipment, the Contractor shall start the equipment, at least half load, once weekly for an adequate period of time to ensure that the equipment does not deteriorate from lack of use.
 - 3. Lubricants shall be changed upon completion of installation and as frequently as required thereafter during the period between installation and acceptance.
 - 4. Prior to acceptance of the equipment, the Contractor shall have the manufacturer inspect the equipment and certify that its condition has not been detrimentally affected by the long storage period. Such certifications by the manufacturer shall be deemed to mean that the equipment is judged by the manufacturer to be in a condition equal to that of equipment that has been shipped, installed, tested, and accepted in a minimum time period. As such, the manufacturer will guaranty the equipment equally in both instances. If such a certification is not given, the equipment shall be judged to be defective. It shall be removed and replaced at the Contractor's expense.

END OF SECTION

SECTION 02050

DEMOLITION AND ALTERATIONS

PART 1 – GENERAL

1.01 DESCRIPTION:

- A. Demolish and alter existing facilities as indicated on drawings, as specified, and as directed by Engineer.
- B. Remove, salvage, or otherwise dispose of demolished materials as shown on the drawings.

1.02 RELATED WORK:

- A. Division 1: General Requirements
- B. Section 02210: Earth Excavation, Backfill, Fill, and Grading.
- C. Section 02160: Temporary Support Systems

1.03 SUBMITTALS:

- A. Shop Drawings: Submit the following in accordance with Section 01300 - SUBMITTALS.
 - 1. Submit to Engineer for review, a demolition plan describing proposed sequence, methods, and equipment for demolition and disposal of each structure.

1.04 QUALITY ASSURANCE:

- A. Demolish and remove existing construction, utilities, equipment, and appurtenances without damaging integrity of existing structures, equipment, and appurtenances that are to remain.
- B. Store equipment to be salvaged for relocation where directed by Engineer, and if necessary, protect from damage during work.
- C. Repair or remove items that are damaged. Repair and install damaged items at no additional compensation and to condition at least equal to that which existed prior to start of work.
- D. Exercise all necessary precautions for fire prevention. Make acceptable fire extinguishers available at all times in areas where demolition work by burning torches is being done.

- E. Do not burn demolition debris on or near site.
- F. Protect persons and property throughout progress of work. Proceed in such manner as to minimize spread of dust and flying particles and to provide safe working conditions for personnel.
- G. Maintain circulation of traffic within area at all times during demolition operations.
- H. Obtain permission from Engineer before abandoning or removing any existing structures, materials, equipment, and appurtenances.
- I. Make necessary arrangements with and perform work required by utility companies and municipal departments for discontinuance or interruption of utility services due to demolition work.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION

3.01 PROPERTY MARKER DEMOLITION:

- A. Provide three (3) reference points for each survey marker and monument removed, established by a licensed civil engineer or land surveyor and record locations and designations of survey markers and monuments prior to removal.
- B. Store removed markers and monuments during demolition work, and replace upon completion of work. Re-establish survey markers and monuments in conformance with recorded reference points. Forward letter to Engineer signed by licensed civil engineer or land surveyor verifying re-establishment of survey markers and monuments.

3.02 DEMOLITION:

- A. Confine apparatus, storage of materials, demolition work, new construction, and operations of workmen to areas that will not interfere with continued use and operation of entire facility. Provide and maintain lights, barriers, and temporary passageways for free and safe access.
- B. Wet down work during demolition operations to prevent dust from arising. Provide maximum practicable protection from inclement weather for materials, equipment, and personnel located in partially dismantled structures.
- C. Provide shoring or bracing where necessary to prevent settlement or displacement of existing or new structures and where specifically called out in the documents (slab near RAS pumps, exposed pipes, and duct banks). Do not overload floors. Complete demolition work on upper levels before disturbing supporting members on lower levels.

- D. Prior to return to service, remove all demolition debris from existing wastewater process tanks that are to remain in service after this project.
- E. Clean tanks of materials unsuitable for fill, where below-grade portions of structures are not indicated to be removed. Demolish foundation walls to a depth of not less than two-feet below existing ground level. Break tank floors into pieces having area not more than four-square feet with well-defined cracks through full depth of floor. Provide holes having area at least one-square foot through floors at intervals of ten-feet lengthwise and crosswise.
- F. Fill cellars and tanks with acceptable solid fill resulting from removal operations and/or with suitable borrow material to level of adjacent ground. Place and compact fill in accordance with applicable requirements of Section 02210. Do not place solid fill from removal operation above an elevation one-foot below final grade.
- G. Cap or plug with brick and mortar, as indicated, pipes and other conduits abandoned due to demolition.

3.03 SALVAGE:

- A. The District has right of first refusal for all materials removed as a result of the project.
- B. Materials, equipment, and appurtenances removed, that are not designated for relocation or desired by the District, become property of Contractor. Haul from site and properly dispose of at no additional compensation.
- C. Remove the ten pump motors and turn over to the District. Place removed equipment in storage area south of the chlorination facilities.
- D. Remove four indicated VFD and turn over to the District. Properly dispose of the other VFDs that are not indicated to be salvaged.

END OF SECTION

SECTION 02160

TEMPORARY EXCAVATION SUPPORT SYSTEMS

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. Design, furnish, and install temporary excavation support systems as required to maintain lateral support, prevent loss of ground, limit soil movements to acceptable limits, and protect from damage existing and proposed improvements including, but not limited to, pipelines, duct banks, structures, roadways, and other facilities.
- B. The requirement of sheeting left in place in areas indicated on the drawings does not relieve the Contractor from the responsibility of furnishing and installing proper temporary excavation support systems in other areas.
- C. Common types of excavation support system include, but are not limited to, singular or multiple stages comprised of cantilevered or internally braced soldier piles and lagging, steel sheet-pile wall, timber sheet-pile wall, trench box, or combinations thereof. Trench box temporary excavation support system is only acceptable for pipe or utility trench excavations. Temporary unsupported open cut excavation with stable sloping sides is allowed where applicable.
- D. Wherever the word "sheeting" is used in this section or on the contract drawings, it shall be in reference to any type of excavation support system specified except trench box.
- E. Construction of the temporary excavation support systems shall not disturb the existing structures or the completed proposed structures. Damage to such structures shall be repaired by the Contractor at no additional cost to the Owner.
- F. The Contractor shall bear the entire cost and responsibility of correcting any failure, damages, subsidence, upheaval, or cave-ins as a result of improper installation, maintenance, or design of the temporary excavation support systems. The Contractor shall pay for all claims, costs, and damages that arise as a result of the work performed, at no additional cost to the Owner.

1.02 RELATED WORK:

- A. Division 1: General Requirements

- B. Section 02050: Demolition and Alterations
- C. Section 02210: Earth Excavation, Backfill, Fill, and Grading
- D. Section 03300: Cast-in-Place Concrete

1.03 REFERENCES:

A. American Society for Testing and Materials (ASTM):

1. A36: Standard Specification for Structural Steel
2. A328: Standard Specification for Steel Sheet Piling
3. A416: Standard Specification for Strand Steel, Uncoated Seven-Wire for Prestressed Concrete
4. A722: Specification for Uncoated High-Strength Steel Bar for Prestressing Concrete
5. A615: Standard Specifications for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

B. American Wood-Preserves Association (AWPA) Standards.

C. American Welding Society (AWS) Code: D1.1.

D. Federal Standard, FS TT-W-571: Wood Preservation and Treating Practices.

E. Occupational Safety and Health Administration (OSHA) Standards and Regulations contained in 29 CFR 1926 Subpart P - Excavation

F. American Concrete Institute (ACI)

1. ACI 304: Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete.

1.04 SUBMITTALS:

A. Shop Drawing: Submit the following in accordance with Section 01300 - SUBMITTALS:

1. Submit the following qualifications four (4) weeks prior to the construction:

- a. Qualifications of Contractor's temporary excavation support system designer as specified in Paragraph 1.05 D.
- b. Qualifications of Contractor's temporary excavation support system installer as specified in Paragraph 1.05 E.
- c. Qualifications of Contractor's independent tieback testing laboratory as specified in Paragraph 1.05 F, if a tieback system is utilized.
- d. Qualifications of Contractor's temporary excavation support system installation supervisor as specified in Paragraph 1.05 G.

2. Submit a temporary excavation support plan stamped and signed by a Registered Professional Engineer at least two weeks prior to start of the construction. Do not submit design calculations. The review will be only for the information of the Owner and third parties for an overall understanding of the project relating to access, maintenance of existing facilities, and proper utilization of the site. The Contractor shall remain responsible for the adequacy and safety of the means, methods, and sequencing of construction. The plan shall include the following items as a minimum:

- a. Proposed temporary excavation support system(s), details, location, layout, depths, extent of different types of support relative to existing features, and the permanent structures to be constructed, and methods and sequence of installation and removal.
- b. Certificate of Design: Refer to Section 01300.
- c. If utilizing a tieback system, include tieback installation procedures and criteria for acceptance of tiebacks for performance and proof tests. Submit the tieback testing results to the Engineer for information only.
- d. Requirements of dewatering during the construction.
- e. Minimum lateral distance from the edge of the excavation support system for use for vehicles, construction equipment, and stockpiled construction and excavated materials.
- f. List of equipment used for installing the excavation support systems.

- g. A plan to monitor movements of the ground adjacent to excavation support systems and adjacent structures. The plan shall include, but not be limited to locations, details, and monitoring schedule of geotechnical instruments such as survey markers (reference points on structures).
3. Submit a Construction Contingency Plan specifying the methods and procedures to maintain temporary excavation support system stability if the allowable movement of the adjacent ground and adjacent structures is exceeded.
4. For excavation support systems left in place, submit the following as-built information prior to backfilling and covering the excavation support systems:
- a. Survey locations of the temporary excavation support systems, including coordinates of the ends and points of change in direction.
 - b. Type of temporary excavation support system.
 - c. Elevations of top and bottom of the excavation support systems left in place.

1.05 QUALITY ASSURANCE:

- A. Provide in accordance with Section 01400 and as specified.
- B. Conform to the requirements of the OSHA Standards and Interpretations: "Part 1926 Subpart P - Excavation, Trenching, and Shoring", and all other applicable laws, regulations, rules, and codes.
- C. All welding shall be performed in accordance with AWS D1.1.
- D. Prepare design, including calculations and drawings, under the direction of a Professional Engineer registered in the State of Illinois and having the following qualifications:
 - 1. Not less than ten (10) years experience in the design of specific temporary excavation support systems to be used.
 - 2. Completed not less than five (5) successful temporary excavation support system projects of equal type, size, and complexity within the last five (5) years.

E. Temporary Excavation Support System Installer's Qualifications:

1. Not less than three (3) years experience in the installation of similar types and equal complexity as the proposed system.
2. Completed not less than three (3) successful excavation support systems of similar type and equal complexity as the proposed system.

F. If utilizing a tieback system, employ an independent testing laboratory to test the tieback system with the following qualifications:

1. Be accredited by the American Association of State Highway and Transportation Officials (AASHTO) Accreditation Program.
2. Employ personnel conducting testing who are trained in the methods and procedures to test and monitor tieback systems of similar type and equal complexity, as the proposed system.
3. Have not less than five (5) years experience in testing of tieback systems of similar type and equal complexity as the proposed system.
4. Have successfully tested at least three (3) tieback systems of similar type and equal complexity as the proposed system.

G. Install all temporary excavation support systems under the supervision of a supervisor having the following qualifications:

1. Not less than five (5) years experience in installation of systems of similar type and equal complexity as the proposed system.
2. Completed at least five (5) successful temporary excavation support systems of similar type and equal complexity as the proposed system.

1.06 DESIGN CRITERIA:

- A. Design of temporary excavation support systems shall meet the following minimum requirements:
1. Support systems shall be designed for earth pressures, hydrostatic pressure, equipment, temporary stockpiles, construction loads, and other surcharge loads.
 2. Design a bracing system to provide sufficient reaction to maintain stability.
 3. Limit movement of ground adjacent to the excavation support system to be within the allowable ground deformation as specified.
 4. Design the embedment depth below bottom of excavation to minimize lateral and vertical earth movements and provide bottom stability. Toe of braced temporary excavation support systems shall not be less than 5 feet below the bottom of the excavation.
 5. Design temporary excavation support systems to withstand an additional 2 feet of excavation below proposed bottom of excavation without redesign except for the addition of lagging and/or bracing.
 6. Maximum width of pipe trench excavation shall be as indicated on the drawings.
 7. Do not cast permanent structure walls directly against excavation support walls.

1.07 DELIVERY, STORAGE AND HANDLING:

- A. Provide in accordance with Sections 01610 and as specified.
- B. Store sheeting and bracing materials to prevent sagging which would produce permanent deformation. Keep concentrated loads which occur during stacking or lifting below the level which would produce permanent deformation of the material.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Structural Steel: All soldier piles, wales, rakers, struts, wedges, plates, waterstop, and accessory steel shapes shall conform to ASTM A36.
- B. Steel Sheet Piling: ASTM A328, continuous interlocking type.
- C. Timber Lagging Left in Place: Pressured treated per appropriate AWPA standards.
- D. Tieback Tendons: Tieback tendons shall be high strength steel wire strand cables conforming to ASTM A416, or bars conforming to ASTM A722. Splicing of individual cables shall not be permitted.
- E. Raker Ties: ASTM A615 Grade 60.
- F. Cement Grout Materials and Admixtures for Tieback Anchorages: Grout cube strength shall be a minimum 3500 psi at 7 days and 5000 psi at 28 days.
- G. Concrete: Section 03300.
- H. Tamping tools adapted for backfilling voids after removal of the excavation support system.
- I. Provide specific trench box sizes for each pipe and utility excavation with structural capacity of retaining soil types as described in OSHA's 29 CFR Part 1926 Subpart P.

2.02 EQUIPMENT:

- A. A vibratory hammer shall be utilized for driving temporary sheet piling.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Installation of the temporary excavation support systems shall not commence until the related earth excavation and dewatering submittals have been reviewed by the Engineer with all Engineer's comments satisfactorily addressed.
- B. Install excavation support systems in accordance with the temporary excavation support plan.

- C. If utilizing a tieback system, all performance and proof tests shall be conducted in the presence of the Engineer. Testing performed without the Engineer present will not be accepted. Repeat testing in the Engineer's presence at no additional cost to the Owner.
- D. Do not drive sheeting within 100 feet of concrete less than seven (7) days old.
- E. Carry out program of temporary excavation support in such a manner as to prevent undermining or disturbing foundations of existing structures, of work ongoing, or of work previously completed.
- F. Bottom of the trench box excavation support system shall be above the pipe invert prior to installing the pipe.
- G. Install and read geotechnical instrumentation in accordance with the temporary excavation support plan. Notify the Engineer immediately if any geotechnical instrumentation is damaged. Repair or replace damaged geotechnical instrumentation at the sole option of the Engineer and at no additional cost to the Owner.
- H. Continuously monitor movements of the ground adjacent to excavation support systems and adjacent structures. In events of the measured movements approaching or exceeding the allowable movements, take immediate steps to arrest further movement by revising procedures such as providing supplementary bracing, filling voids behind the trench box, supporting utilities, or other measures (Construction Contingency Plan) as required.
- I. The temporary support system shall be designed to accommodate existing site features, such as structures and utilities. Relocation of such site features is not acceptable.

3.02 GROUND DEFORMATION ADJACENT TO EXCAVATION SUPPORT SYSTEMS:

- A. Allowable Vertical (heave/settlement) and Lateral Movements: two inches (2") maximum for the trench box excavation support system and one (1) inch maximum for other types of excavation support systems, at any location behind the excavation support system.
- B. Monitoring personnel shall use a procedure for reading and recording geotechnical instrumentation data which compares the current reading to the last reading during data collection to eliminate spurious readings.

- C. Plot the observed ground deformation readings versus time. Annotate the plots with construction loading and excavation events having an impact on the readings. Evaluate plots by means of secondary rate-of-change plots to provide early warning of accelerating ground movements.
- D. Notify the Engineer when the allowable ground deformation is exceeded.
- E. Implement Construction Contingency Plan under direction of the temporary excavation support system designer and the Engineer.

3.03 REMOVAL OF EARTH RETENTION SYSTEM:

- A. Sheeting shall be left in place unless otherwise indicated or approved in writing by the Engineer.
- B. When indicated or approved by the Engineer, remove the temporary excavation support system without endangering the constructed or adjacent structures, utilities, or property. Immediately backfill all voids left or caused by withdrawal of temporary excavation support systems with bank-run gravel, screened gravel, or select borrow by tamping with tools specifically adapted for that purpose.
- C. When tiebacks are used, release tension in tiebacks as the excavation is backfilled. Do not leave tensioned tieback in place at the completion of the work.
- D. The excavation support system left-in-place shall be cut-off a minimum of two (2) feet below the bottom of the next higher foundation level or a minimum of five (5) feet below finished grade.
- E. Conduct survey of the locations and final cut-off elevations of excavation support systems left in place.

END OF SECTION

SECTION 02210

EARTH EXCAVATION, BACKFILL, FILL, AND GRADING

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. Perform the following earth excavation, backfill, fill, and grading as indicated or specified:
- B. Make excavations to accommodate piping, conduits, foundations, and other structures.
- C. Provide materials for backfilling excavations and constructing embankments and fills as indicated and specified.
- D. Grade surfaces to meet finished grades indicated.
- E. Immediately notify the Engineer if suspected hazardous materials are encountered and cease operations in that part of work.
- F. Remove boulders within the excavation limits.

1.02 RELATED WORK:

- A. Division 1: General Requirements
- B. Section 02160: Temporary Excavation Support Systems
- C. Section 02223: Screened Gravel
- D. Section 02224: Bank-run Gravel
- E. Section 02225: Select Borrow
- F. Section 02435: Crushed Stone
- G. Section 03300: Cast-in-Place Concrete

1.03 REFERENCES:

- A. American Society for Testing and Materials (ASTM) Publications:
 - 1. C33: Specification for Concrete Aggregates.

2. C136: Sieve Analysis of Fine and Coarse Aggregates.
 3. D421: Practice for Dry Preparation of Soil Samples for Particle Size Analysis and Determination of Soil Constants.
 4. D422: Test Method for Particle-Size Analysis of Soils.
 5. D1140: Test Method for Amount of Material in Soils Finer than the No. 200 Sieve.
 6. D1556: Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
 7. D1557: Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lb/ft³).
 8. D2167: Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
 9. D2922: Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods. (Shallow Depth).
 10. D3017: Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
 11. D4318: Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
 12. D4718: Practice for Correction of Unit Weight and Water Content for Soils Containing Oversized Particles.
 13. D4944: Test Method for Field Determination of Water (Moisture) Content of Soil by the Calcium Carbide Pressure Tester Method.
 14. D4959: Test Method for Field Determination of Water (Moisture) Content of Soil by Direct Heating Method.
 15. D5080: Test Method for Rapid Determination of Percent Compaction.
- B. Occupational Safety and Health Administration (OSHA) Standards and Regulations contained in Title 29: 1926 Subpart P - Excavations, Trenching and Shoring.

1.04 DEFINITIONS:

- A. Percentage of compaction is defined as the ratio of the field dry density, as determined by ASTM D1556 to the maximum dry density determined by ASTM D1557 Procedure C, multiplied by 100.
- B. Proof Roll: Compaction with a minimum of 4 passes of a vibratory steel drum or rubber tire roller. Vibratory plate compactors shall be used in small areas where vibratory steel drum or rubber tire roller can not be used.
- C. Acceptable Material: Material which does not contain organic silt or organic clay, peat, vegetation, wood or roots, stones or rock fragments over 6-inch in diameter, porous biodegradable matter, loose or soft fill, excavated pavement, construction debris, or refuse. Stones or rock fragments shall not exceed 40 percent by weight of the backfill material.
- D. Unacceptable Materials: Materials do not comply with the requirements for the acceptable material or which cannot be compacted to the specified or indicated density.

1.05 SUBMITTALS:

- A. Shop Drawings: Submit the following in accordance with Section 01300 - SUBMITTALS:
 - 1. Qualifications of the Contractor's Independent Testing Laboratory four (4) weeks prior to the execution of any earth excavation, backfilling, filling, or compaction process.
 - 2. Submit an excavation, backfilling, and filling plan at least two weeks prior to start of any earth moving activities. The review will be only for the information of the Owner and third parties for an overall understanding of the project relating to access, maintenance of existing facilities, and proper utilization of the site. The Contractor shall remain responsible for the adequacy and safety of the means, methods, and sequencing of construction. The plan shall include, but not be limited to, the following items:
 - a. Detailed sequence of work.
 - b. General description of construction methods.
 - c. Numbers, types, and sizes of equipment proposed to perform excavation and compaction.
 - d. Details of dust control measures.

- e. Proposed locations of stockpiled excavation and/or backfill materials.
 - f. Proposed surplus excavated material off-site disposal areas and required permits.
 - g. Details of erosion and sedimentation control measures which will prevent erosion and sedimentation during the earth moving activities.
3. The following material submittals shall be submitted to the Engineer prior to backfilling and filling:
- a. Screened Gravel: As specified in Section 02223.
 - b. Bank-run Gravel: As specified in Section 02224.
 - c. Select Borrow: As specified in Section 02225.
 - d. Crushed Stone: As specified in Section 02435.
 - e. Other Acceptable Materials: Laboratory testing results of gradation and moisture-density relationship. Submittal shall include specific location of the source and the date when sample was taken.
4. During Construction, submit written confirmation of fill lift thickness, in-place soil moisture content, and percentage of compaction to the Engineer before placing the next lift or constructing foundations.

1.06 QUALITY ASSURANCE AND CONTROL:

- A. Provide in accordance with Section 01400 and as specified.
- B. Excavations shall be performed in the dry, and kept free from water, snow, and ice during construction. Bedding and backfill material shall not be placed in water. Water shall not be allowed to rise upon or flow over the bedding and backfill material.
- C. Temporary Excavation Support Systems: Provide and maintain as specified in Section 02160.
- D. The Contractor shall be solely responsible for making all excavations in a safe manner. All excavation, trenching, and related sheeting, bracing, etc. shall comply with the requirements of OSHA excavation safety standards (29 CFR Part 1926 Subpart P) and State requirements. Where conflict between OSHA and State regulations exists, the more stringent requirements shall apply.

- E. Do not excavate, construct embankments, or fill until all the required submittals have been reviewed by the Engineer.
- F. Formulate excavation, backfilling, and filling schedule and procedures to eliminate possibility of undermining or disturbing foundations of partially and completed structures, pipelines, duct banks, embankments, or existing structures and pipelines.
- G. Employ an independent testing laboratory to perform particle size and gradation analyses in accordance with ASTM D422, and to determine compactibility in accordance with ASTM D1557 for all the proposed backfill and fill materials, and monitoring field compaction operations. The independent testing laboratory shall have the following qualifications:
1. Be accredited by the American Associates of State Highway and Transportation Officials (AASHTO) Accreditation Program.
 2. Have three (3) years experience in sampling, testing, and analysis of soil and aggregates, and monitoring field compaction operations.
 3. Able to provide three (3) references from previous work.
- H. Field Testing and Inspections:
1. By Owners testing laboratory as specified.
 2. Location of tests mutually acceptable to testing laboratory and the Engineer or as directed by the Engineer.
 3. In the event compacted material does not meet specified in-place density, re-compact material and retest this area until specified results are obtained at no additional to the Owner.
 4. Testing laboratory to perform inspection at least once daily to confirm lift thickness and compaction effort for entire fill area.
- I. Methods of Field Testing:
1. In-Place Density: ASTM D1556, ASTM D2167, or ASTM D2922.
 2. In-Place Moisture Content: ASTM D3017, ASTM D4944, or ASTM D4959.
- J. Material Testing Frequency: The following testing frequencies are minimum required for all structural and non-structural fill, grading, and embankment.

1. Field In-Place Density and Moisture Content - Screened gravel and crushed stone shall be compacted as specified and indicated. For other backfill and fill materials, minimum test frequency shall be as follows, and no less than one test per:
 - a. Trenches under structures foundation preparation or roadways subbase: Every 1,000 lin. ft. per lift
 - b. Trenches in areas without structures or roadways: Every 1000 lin. ft. per alternate lift.
 - c. Paved Roadways: Every 200 lin. ft. per lift.
 - d. Paved Areas: 3,500 sq. ft. per lift.
 - e. Under Structure: 1,000 sq. ft. per lift.
 - f. Around Structures: 1,500 sq. ft. per lift.
 - g. Embankment Fills: 10,000 sq. ft. per lift.
2. Moisture Density - One per source, except for screened gravel and crushed stone. Repeat the moisture density test for every 5,000 cubic yard of material use, and whenever visual inspection indicates a change in material gradation as determined by the Engineer.
3. Gradation Analysis - A minimum of one per source and for each moisture density test and whenever visual inspection indicates a change in material gradation.
4. Liquid Limit, Plastic Limit and Plasticity Index - Minimum of one test per 5,000 cubic yard of soil for use as fill material and whenever classification of material is in doubt as determined by the Engineer.

K. Construction Tolerances:

1. Construct finished surfaces to plus or minus 1 inch of the elevations indicated.
2. Grade cut and fill areas to plus or minus 0.20 foot of the grades indicated.
3. Complete embankment edges to plus or minus 6 inches of the slope lines indicated.
4. Provide the Engineer with adequate survey information to verify compliance with above tolerances.

- L. Cut pavement with a saw or pneumatic tools to prevent damage to remaining pavement without extra compensation. Where pavement is removed in large pieces, dispose of pieces before proceeding with excavation.
- M. Pipes, drains, and other utilities may exist in certain locations not indicated on drawings. No attempt has been made to show all services. Completeness or accuracy of information given is not guaranteed.
- N. Dig test pits considered as incidental to the normal excavation as required to perform the work and as indicated and specified in this Section, at no additional compensation.
- O. Carefully support and protect from damage, existing pipes, poles, wires, fences, curbing, property line markers, and other structures, which the Engineer determines must be preserved in place without being temporarily or permanently relocated. Should such items be damaged, restore without compensation therefor, to at least as good condition as that in which they were found immediately before the work was begun.
- P. Whenever certain existing structures, as described below, are encountered, and the Engineer so directs, change the location, remove and later restore, or replace such structures, or assist the Owner in doing so. Such work to be paid for as Extra Work.
- Q. In removing existing pipes or other structures, include for payment only those new materials which are necessary to replace those unavoidably damaged as determined by the Engineer.
- R. The preceding two paragraphs apply to pipes, wires, and other structures which meet the following: (a) are not indicated on the drawings or otherwise provided for, (b) encroach upon or are encountered near and substantially parallel to the edge of the excavation, and (c) in the opinion of the Engineer, will impede progress to such an extent that satisfactory construction cannot proceed until they have been changed in location, removed (to be later restored), or replaced.
- S. Restore existing property or structures as promptly as practicable.
- T. If material unacceptable for foundation (in the opinion of the Engineer) is found at or below the grade to which excavation would normally be carried in accordance with the drawings and/or specifications, remove such material to the required width and depth as directed by the Engineer and replace it with screened gravel, select borrow, or concrete.
- U. Do not remove excavation materials from the site of the work or dispose of except as directed or permitted by the Engineer.
- V. Haul away and dispose of surplus excavated materials at locations selected by Contractor and acceptable to the Engineer, at no additional cost to the Owner.

- W. During progress of work, conduct earth moving operations and maintain work site so as to minimize the creation and dispersion of dust. Furnish and spread calcium chloride if the Engineer decides that it is necessary for more effective dust control.
- X. Provide suitable and safe bridges and other crossings where required for accommodation of travel, and to provide access to private property during construction, and remove said structures thereafter.

PART 2 - PRODUCTS

2.01 GENERAL:

- A. Use only acceptable materials from excavations or borrows. Concrete from demolition and coring shall be disposed off site and shall not be used as backfill in excavations.
- B. Provide 1,500 psi controlled low strength mix (CLSM) concrete, screened gravel, bank-run gravel, fine aggregate, select borrow, and crushed stone.
- C. Provide Fine Aggregate conforming to ASTM C33.
- D. Provide erosion/sedimentation control devices as necessary, including geotextile fabric.

2.02 EQUIPMENT:

- A. The compaction equipment shall be selected by the Contractor, and shall be capable of consistently achieving the specified compaction requirements. The selected compaction equipment shall meet the following minimum requirements:
 - 1. Manually operated vibratory plate compactors weighing no less than 200 pounds with vibration frequency no less than 1600 cycles per minute.
 - 2. Vibratory steel drum or rubber tire roller weighing at least 12,000 pounds.

PART 3 - EXECUTION

3.01 SITE MAINTENANCE:

- A. Roadway and Site Leveling: Grade roadway and site as to maintain them in a level un-rutted condition and to eliminate puddling of surface and subsurface water.

3.02 EXCAVATION:

- A. Execution of any earth excavation shall not commence until the related dewatering, excavation support systems, and backfill and fill materials submittals are reviewed by the Engineer and all Engineer's comments satisfactorily addressed.
- B. Carry out program of excavation, dewatering, and excavation support systems to eliminate possibility of undermining or disturbing foundations of existing structures or of work previously completed under this contract.
- C. Excavate to widths that give suitable room for building structures or laying and jointing piping.
- D. Do not plow, scrape, or dig by machinery near to finished subgrade in a manner that would result in disturbance of subgrade.
- E. Excavate to lines and grades indicated in an orderly and continuous program.
- F. Establish limits of excavation to allow adequate working space for installing forms and for safety of personnel.
- G. Excavate to elevations indicated, or deeper, as directed by the Engineer, to remove unacceptable bottom material.
- H. Exercise care to preserve material below and beyond the lines of excavations.
- I. Place excavated material at the approved stockpile locations and in no case closer than 3 feet from edge of excavations, to prevent cave-ins of bank sides.
- J. Regard small, less than one-half (0.5) cubic yard, boulders, rock fragments, and concrete encountered during excavation as a normal part of in-place soils and not included for payment as rock.
- K. Excavate for depressed foundations, where mat foundations are indicated as depressed. Sheet and shore existing ground so that adjacent sections of foundation mat will rest on undisturbed ground as indicated. Installation of sheeting shall be in accordance with Section 02160.

3.03 SEPARATION OF EXCAVATED MATERIALS FOR REUSE:

- A. Remove existing pavement only as necessary for prosecution of work.
- B. Carefully remove loam and topsoil from excavated areas. Store separately for further use or furnish equivalent loam and topsoil as directed.

- C. Carefully remove acceptable material from excavated areas and store separately for further use as backfill material.

3.04 TRENCH EXCAVATION:

- A. When pipe is to be laid in gravel bedding or concrete cradle, excavate trench by machinery to, or just below designated subgrade. If material remaining at bottom of trench is disturbed, re-compaction shall be required.
- B. When pipe is to be laid directly on bottom of trench, do not excavate lower part of trenches by machinery to subgrade. Remove remainder of material to be excavated just before placing of pipe by use of hand tools. Form a flat or shaped bottom, true to grade, so pipe will have a uniform and continuous bearing. Support on firm and undisturbed material between joints, except for limited areas where use of pipe slings disturbed the bottom.

3.05 DEPTH OF TRENCH:

- A. Excavate trenches to depths so as to permit pipe to be laid at elevations, slopes, or depths of cover indicated on drawings, and at uniform slopes between indicated elevations.

3.06 WIDTH OF TRENCH:

- A. Make pipe trenches as narrow as practicable and do not widen by scraping or loosening materials from the sides. Make every effort to maintain sides of trenches firm and undisturbed until backfilling has been placed and compacted.
- B. Excavate trenches with approximately vertical sides between spring-line of pipe and elevation 1 ft. above top of pipe.

3.07 TRENCH EXCAVATION IN FILL:

- A. Place and compact material to top of fill or to a minimum height of 1 ft. above top of pipe, whichever is less, when pipe is to be laid in embankment or other recently filled material. Take particular care to ensure maximum consolidation of material under pipe location. Excavate pipe trench as though in undisturbed material.

3.08 EXCAVATION NEAR EXISTING STRUCTURES:

- A. Discontinue digging by machinery when excavation approaches pipes, duct banks, or other underground structures. Continue excavation by use of hand tools. Include such manual excavation in work to be done when incidental to normal excavation and under items involving normal excavation.

- B. Excavate test pits when determination of exact location of pipe or other underground structure is necessary for doing work properly.

3.09 REMOVAL OF SUBSURFACE OBSTRUCTIONS:

- A. Remove indicated subsurface structures and related obstructions to extent shown.
- B. Promptly notify the Engineer when any unexpected subsurface facilities are encountered during excavation such as utility lines and appurtenances, walls, and foundations.

3.10 UNAUTHORIZED EXCAVATION:

- A. When the bottom of any excavation for structures is taken out beyond limits indicated or specified, backfill with screened gravel and crushed stone wrapped with non-woven geotextile fabric or with 1,500 psi CLSM concrete.

3.11 REUSE AND DISPOSAL OF SURPLUS EXCAVATED MATERIALS:

- A. Reuse surplus acceptable excavated materials for backfill; or legally dispose off-site; all as directed or permitted and without additional compensation.

3.12 SUBGRADE PREPARATION AND PROTECTION:

- A. Remove loam and topsoil, loose vegetable matter, stumps, and large roots from areas upon which embankments will be built or material will be placed for grading. Shape subgrade as indicated on drawings, and prepare by forking, furrowing, or plowing so that the first layer of new material placed thereon will be well bonded to it.
- B. As directed by the Engineer, over-excavate unacceptable materials below the foundation subgrade. Backfill the over-excavation with compacted screened gravel or crushed stone.
- C. Proof roll the foundation subgrade prior to backfilling and filling operation, or placing foundation concrete.
- D. Proof roll the pipe trench foundation subgrade prior to backfilling and filling operation, or placing soil-supported pipeline.
- E. Utilize excavating equipment equipped with a toothless or smooth edged, excavating bucket to expose the pipe trench foundation subgrade to avoid disturbance of the bearing surface. Tamp the exposed subgrade with the excavating bucket prior to backfilling and filling operation, or placing soil-supported pipeline.

3.13 CARE AND RESTORATION OF PROPERTY:

- A. Enclose uncut tree trunks adjacent to work in wooden boxes of such height as may be necessary for protection from injury from piled material, equipment, operations, or otherwise due to work. Operate excavating machinery and cranes of suitable type with care to prevent injury to trees not to be cut and particularly to overhanging branches and limbs.
- B. Cut all branches, limbs, and roots smoothly and neatly without splitting or crushing. Neatly trim, cut the injured portions, and cover with an application of grafting wax or tree healing paint as directed.
- C. Protect cultivated hedges, shrubs, and plants which might be injured by the Contractor's operations by suitable means or dig up and temporarily replant and maintain. After construction operations have been substantially completed, replant in original positions and care for until growth is re-established. If cultivated hedges, shrubs, and plants are injured to such a degree as to effect their growth or diminish in their beauty or usefulness, replace by items of equal kind and quality existing at the start of the work.
- D. Do not use or operate tractors, bulldozers, or other power-operated equipment on paved surfaces when their treads or wheels of which are so shaped as to cut or otherwise damage such surfaces.
- E. Restore surfaces damaged by the Contractor's operations to a condition at least equal to that in which they were found immediately before work commenced. Use suitable materials and methods for such restoration.

3.14 BACKFILLING - GENERAL:

- A. Do not place frozen materials in backfill or place backfill upon frozen material. Remove previously frozen material or treat before new backfill is placed.
- B. Do not place, spread, roll, or compact fill material during unfavorable weather conditions. If interrupted by heavy rain or other unfavorable conditions, do not resume until ascertaining that the moisture content and density of the previously placed soil are as specified.
- C. Do not use puddling, ponding, or flooding as a means of compaction.

3.15 MATERIAL PLACEMENT AND COMPACTION REQUIREMENTS:

- A. Select Borrow, and Fine Aggregate:
 - 1. Dump and spread in layers not to exceed 8-inches uncompacted thickness.

2. Compact, fill, and backfill under structure and bedding for pipes (from below pipe to spring line) to not less than 95 percent (95%) modified Proctor. Compact to not less than 90 percent (90%) in other areas unless otherwise indicated.

B. Screened Gravel and Crushed Stone:

1. Dump and spread in layers not to exceed 8-inches (8") uncompact thickness.
2. Compact using self propelled vibratory steel drum or rubber tire rollers with a minimum of four (4) passes in directions perpendicular to one another in open areas. In small areas, use manually operated vibratory plate compactors with a minimum of four (4) passes.

C. Bank-run Gravel and Acceptable materials for use as non-structural fill:

1. Dump and spread in layers not to exceed 12-inches (12") uncompact thickness.
2. Compact to not less than 90 percent (90%) modified Proctor unless otherwise indicated.

- D. Backfilling and filling operation shall be suspended in areas where tests are being made until tests are completed and the testing laboratory has advised the Engineer that adequate densities are obtained.

3.16 STRUCTURAL FILL AND BACKFILL UNDER STRUCTURES:

- A. Compact fill and backfill under structures and pavements with screened gravel, crushed stone, select borrow, or fine aggregate as specified and indicated.

3.17 NON-STRUCTURAL BACKFILL AROUND STRUCTURES:

- A. Use acceptable materials for non-structural backfill around structures and compacted as specified and indicated.
- B. Conduct hydraulic testing as soon as practicable after structures are constructed and other necessary work has been done. Start backfilling promptly after completion of tests.
- C. Deposit material evenly around structure to avoid unequal soil pressure.
- D. Do not place backfill against or on structures until they have attained sufficient strength to support the loads (including construction loads) to which they will be subjected, without distortion, cracking, or other damage.

3.18 BACKFILLING PIPE TRENCHES:

A. General:

1. Begin backfilling and proceed until completed after: the pipes and conduits have been laid, joints have acquired maximum degree of hardness, pipelines and conduits have successfully passed tests and inspections as required in the Specifications, and concrete or masonry structures within the trench have reached their design strength to support all loads.
2. Backfill and compact indicated material under, around, and above pipes, conduits, and other structures to the indicated or specified compaction density requirement. Utilize compaction devices which will not damage the pipe, conduit, or structure within the trench.
3. Do not drop backfill material into trench from a height of more than 5 feet or in a manner which will damage the pipe, conduit, or other structure within trench.

B. Pipe Trenches:

1. Materials:
 - a. From below pipe to one (1) foot above spring line: Use screened gravel or crushed stone as indicated.
 - b. One foot above pipe to finished grade or to pavement subbase: Use bank-run gravel or acceptable materials, unless otherwise indicated.
2. Compacting Around Pipes: Compact material around circumference of pipe and the area between the trench wall and the pipe by hand tamping in 6-inch (6") layers.
3. Compacting Above Pipe: Compact material by hand tamping. If trench width is wide enough to accommodate power tools and the compacted material over the pipe will support the load of the power tools without damage to the pipe, use rollers or other powered compaction equipment able to more readily achieve compaction requirements.

3.19 COMPACTION CONTROL OF BACKFILL, FILL, AND EMBANKMENT:

- A. Compact to density specified and indicated for various types of material. Control moisture content of material being placed as specified or if not specified, at a level slightly lower than optimum.

- B. The soil testing laboratory shall provide inspection during filling or backfilling operations to ensure compaction of screened gravel or crushed stone.
- C. Moisture control may be required either at the stockpile area, pits, or on embankment or backfill. Increase moisture content when material is too dry by sprinkling or other means of wetting uniformly. Reduce moisture content when material is too wet by using ditches, pumps, drainage wells, or other devices and by exposing the greatest possible area to sun and air in conjunction with harrowing, plowing, spreading of material, or any other effective methods.

3.22 ALLOWANCE FOR SHRINKAGE:

- A. Build embankments or backfill to a height above finished grade which will, in the opinion of the Engineer, allow for the shrinkage or consolidation of material. Initially, provide at all points, an excess of at least one percent of total height of backfill measured from stripped surface to top of finished surface.
- B. Supply specified materials and build up low places as directed, without additional cost if embankment or backfilling settles so as to be below the indicated level for proposed finished surface at any time before final acceptance of the work.

END OF SECTION

SECTION 02223
SCREENED GRAVEL

PART 1 – GENERAL

1.01 DESCRIPTION:

- A. Provide and compact screened gravel as indicated and specified.

1.02 RELATED WORK:

- A. Division 1: General Requirements
- B. Section 02210: Earth Excavation, Backfill, Fill, and Grading

1.03 REFERENCES:

- A. American Society for Testing and Materials (ASTM) Publications:
 - 1. C33: Specification for Concrete Aggregates
 - 2. D422: Test Method for Particle-Size Analysis of Soils.

1.04 SUBMITTALS:

- A. Shop Drawings: Submit the following in accordance with Section 01300 - SUBMITTALS:
 - 1. Gradation test result from the soil testing laboratory, at least two (2) weeks prior to hauling material, for the Engineer's acceptance.
 - 2. Submit a 20-lb. sample of the material when requested by the Engineer.

1.05 QUALITY ASSURANCE:

- A. Provide in accordance with Section 01400 and as specified.
- B. Qualifications of the independent soil testing laboratory as specified in Section 02210.
- C. Maximum particle size and gradation analyses shall be performed in accordance with ASTM D422.
- D. Material testing frequency and requirements as specified in Section 02210.

PART 2 – PRODUCTS

2.01 MATERIAL:

- A. Screened gravel: Gradation and physical property requirements of screened gravel shall conform to ASTM C33, Coarse Aggregate number 67.
- B. Screened gravel shall be free from roots, leaves, and other organic materials, and free of ice, snow, frost, and frozen soil particles.
- C. Crushed rock of equivalent size and grading may be used instead of screened gravel.

PART 3 – EXECUTION

3.01 PLACEMENT AND COMPACTION:

- A. Specified in Section 02210 and as indicated on the drawings.

END OF SECTION

Not to be used for bidding purposes

SECTION 02224

BANK-RUN GRAVEL

PART 1 – GENERAL

1.01 DESCRIPTION:

- A. Provide and compact bank-run gravel as indicated and specified.

1.02 RELATED WORK:

- A. Division 1: General Requirements
- B. Section 02210: Earth Excavation, Backfill, Fill, and Grading

1.03 REFERENCES:

- A. American Society for Testing and Materials (ASTM) Publications:
 - 1. D422: Test Method for Particle-Size Analysis of Soils.
 - 2. D1140: Test Method for Amount of Material in Soils Finer than the No. 200 Sieve.
 - 3. D1557: Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³).

1.04 SUBMITTALS:

- A. Shop Drawings: Submit the following in accordance with Section 01300 - SUBMITTALS:
 - 1. Gradation and compaction test results from the soil testing laboratory, at least two (2) weeks prior to hauling material, for the Engineer's acceptance.
 - 2. Submit a 20-lb. sample of the material when requested by the Engineer.

1.05 QUALITY ASSURANCE:

- A. Provide in accordance with Section 01400 and as specified.
- B. Qualifications of the independent soil testing laboratory as specified in Section 02210.

C. Maximum particle size and gradation analyses shall be performed in accordance with ASTM D422. Soil compaction test shall be performed in accordance with ASTM D1557 Procedure C.

D. Material testing frequency and requirements as specified in Section 02210.

PART 2 – PRODUCTS

2.01 MATERIAL:

A. Bank-run gravel shall be obtained from approved natural deposits and unprocessed except for the removal of deleterious materials and stones larger than the maximum size permitted.

B. Bank-run gravel shall be unfrozen and substantially free from vegetation, roots, loam and other organic matter, clay, snow, frozen particles, and other fine or harmful substances.

C. Bank-run gravel: Inorganic granular material meeting the following gradation:

<u>Sieve Designation</u>	<u>Percentage by Weight Passing Square Mesh Sieves</u>
6 in.	100
2 in.	80 - 100
No. 4	20 - 65
No. 200	0 - 12

PART 3 – EXECUTION

3.01 PLACEMENT AND COMPACTION:

A. Specified in Section 02210 and where indicated on the drawings.

END OF SECTION

SECTION 02225

SELECT BORROW

PART 1 – GENERAL

1.01 DESCRIPTION:

- A. Provide and compact select borrow as indicated and specified.

1.02 RELATED WORK:

- A. Division 1: General Requirements
- B. Section 02210: Earth Excavation, Backfill, Fill, and Grading

1.03 REFERENCES:

- A. American Society for Testing and Materials (ASTM) Publications:
 - 1. C33: Specification for Concrete Aggregates
 - 2. D422: Test Method for Particle-Size Analysis of Soils.
 - 3. D1140: Test Method for Amount of Material in Soils Finer than the No. 200 Sieve.
 - 4. D1557: Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³).

1.04 SUBMITTALS:

- A. Shop Drawings: Submit the following in accordance with Section 01300 - SUBMITTALS:
 - 1. Gradation and compaction test results from the soil testing laboratory, at least two (2) weeks prior to hauling material, for the Engineer's acceptance.
 - 2. Submit a 20-lb. sample of the material when requested by the Engineer.

1.05 QUALITY ASSURANCE:

- A. Provide in accordance with Section 01400 and as specified.

- B. Qualifications of the independent soil testing laboratory as specified in Section 02210.
- C. Maximum particle size and gradation analyses shall be performed in accordance with ASTM D422. Soil compaction test shall be performed in accordance with ASTM D1557 Procedure C.
- D. Material testing frequency and requirements as specified in Section 02210.

PART 2 - PRODUCT

2.01 MATERIAL:

- A. Use only material free from roots, leaves, and organic matter, and free of ice, snow, frost, and frozen soil particles.
- B. Select borrow shall meet the following gradation:

<u>Sieve Designation</u>	<u>Percentage by Weight Passing Square Mesh Sieves</u>
3 in.	100
1-1/2 in.	70 - 100
3/4 in.	50 - 85
No. 4	30 - 50
No. 50	10 - 25
No. 200	0 - 5

- C. Soil particles shall conform to the physical property requirements of ASTM C33.

PART 3 – EXECUTION

3.01 PLACEMENT AND COMPACTION:

- A. Specified in Section 02210 and as indicated on the drawings.

END OF SECTION

SECTION 02435

CRUSHED STONE

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. Provide and compact crushed stone as indicated and specified.

1.02 RELATED WORK:

- A. Division 1: General Requirements
- B. Section 02210: Earth Excavation, Backfill, Fill, and Grading

1.03 REFERENCES:

- A. American Society for Testing and Materials (ASTM) Publications:
 - 1. C33: Specification for Concrete Aggregates
 - 2. D422: Test Method for Particle-Size Analysis of Soils.

1.04 SUBMITTALS:

- A. Shop Drawings: Submit the following in accordance with Section 01300 - SUBMITTALS:
 - 1. Gradation test result from the soil testing laboratory, at least two (2) weeks prior to hauling material, for the Engineer's acceptance.
 - 2. Submit a 20-lb. sample of the material when requested by the Engineer.

1.05 QUALITY ASSURANCE:

- A. Provide in accordance with Section 01400 and as specified.
- B. Qualifications of the independent soil testing laboratory as specified in Section 02210.
- C. Maximum particle size and gradation analyses shall be performed in accordance with ASTM D422.
- D. Material testing frequency and requirements as specified in Section 02210.

PART 2 - PRODUCTS

2.01 MATERIAL:

- A. Crushed Stone: Gradation and physical property requirements of screened gravel shall conform to ASTM C33, Coarse Aggregate number 67.
- B. Crushed stone shall be free from roots, leaves, and other organic materials, and free of ice, snow, frost, and frozen soil particles.

PART 3 - EXECUTION

3.01 PLACEMENT AND COMPACTION:

- A. Specified in Section 02210 and as indicated on the drawings.

END OF SECTION

Not to be used for bidding purposes

SECTION 02480

LANDSCAPING

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. Provide loaming, fertilizing, seeding, mulching, and related work as indicated and specified.

1.02 REFERENCE STANDARD:

- A. American Standard for Nursery Stock.

1.03 SUBMITTALS:

- A. Shop Drawings: Submit the following in accordance with Section 01300 - SUBMITTALS:

1. Certify, invoice, or order plants and seed for each shipment grown within 300 miles of Winnebago County Illinois, free of disease and insect pests. Submit certificates to Engineer.
2. Prior to placement of any mulch, deposit at a location on site suitable to Engineer, 1/2 cubic yard. sample of mulch for examination. After mulch sample is reviewed by the Engineer, provide mulch conforming to accepted sample.
3. Submit to Engineer a sample of proposed soil separator mat and manufacturer's specification for mat.
4. Submit with seed, certificates concerning seed mixture, purity, germinating value, and crop year identification.
5. Submit test samples of loam to a certified soils consultant to determine fertilizer and lime requirements and return two copies of results for implementation.
6. Prior to end of maintenance period, furnish two copies of written maintenance instructions for maintenance and care of installed plants and lawn areas.

1.04 QUALITY ASSURANCE:

A. Ability to Deliver:

1. Investigate sources of supply and make assurances that materials will be supplied as indicated and quality noted and specified before submitting bid.
2. Failure to take this precaution will not relieve responsibility for furnishing and installing material in accordance with Contract requirements, and without additional expense to OWNER.

B. Inspection:

1. Upon delivery and before planting, Engineer will inspect materials.
2. Inspection and approval by Engineer of plants is for quality, size, and variety only and in no way impairs the right of rejection for failure to meet other requirements during progress of work.

C. General:

1. Furnish suitable quantities of water, hose, and appurtenances.
2. Use loam, having prior vegetative growth that did not contain toxic amounts of either acid or alkaline elements.
3. Begin maintenance immediately after each portion of lawn is seeded and continue for minimum of 45 days.
4. Repair or replace seeded areas, plants, shrubs, and trees which, in judgment of Engineer, have not survived and grown in a satisfactory manner, for a period of one year after acceptance.
5. Provide as specified seedings or plantings replacements of the same type and size as specified.
6. Dry loam test samples to constant weight at temperature of 230 deg. F, plus or minus 9 degrees.

1.05 DELIVERY, STORAGE AND HANDLING:

A. Provide in accordance with Section 01610.

B. Delivery:

1. Deliver fertilizer to site in original unopened containers bearing manufacturer's guaranteed chemical analysis, name, trade name, trademark, and conformance to state law.
2. Delivery seed in original bags with legible identification labels.
3. Notify Engineer of delivery schedule in advance so materials may be inspected at jobsite.

C. Storage:

1. Store materials in cool dry location.

1.06 JOB CONDITIONS:

A. It is the intent of this specification that existing trees within grading and seeding limits, not disturbed by building operations, be saved and protected, except where specified to be removed. Clear trees required to be removed only after approval by Engineer. Engineer directs variations required in grading on the job.

B. Planting Seasons:

1. Recommended Spring Planting Season: From time soil can be satisfactorily worked until following dates at end of planting season:

a. Lawns - May 15.

2. Recommended Fall Planting Season: Commence and terminate at time listed below:

a. Lawns - August 15 to October 1.

C. Perform actual planting only when weather and soil conditions are suitable in accordance with locally accepted practice.

D. Protection:

1. Protect seeded and planted areas against damage by trespass and other causes.

2. Protect work until accepted.
 3. Replace, repair, restake, or replant as directed by Engineer, and at own expense, seeding or planting which is damaged.
 4. If planting is done after lawn preparation, protect lawn areas, repair damage resulting from planting operations.
- E. Wherever landscape work must be executed in conjunction with construction of other work, arrange a schedule of procedure that will permit execution of landscape work as specified.

1.07 WARRANTY:

- A. Provide in accordance with the Contract Documents.
- B. Guarantee new plant material through one full growing season after plants are installed.
 1. Guarantee plants replaced under this for one full growing season from date of replacement.
 2. Repair damage to plants or lawns during plant replacement.
- C. Guarantee lawn areas for duration of one full year after seeding to be alive and in satisfactory growth at end of guarantee period.
 1. For purpose of establishing an acceptable standard, scattered bare spots, none larger than 1 square foot, will be allowed up to a maximum of 3% of lawn area.

PART 2 - PRODUCTS

2.01 BONE MEAL:

- A. Commercial raw bone meal, finely ground and containing a minimum of 1 percent nitrogen and 18 percent phosphoric acid.

2.02 MULCH:

- A. Shredded pine bark free of wood chips, stones, branches, or other deleterious material. Bark shredded in strips not larger than 3 inches in any dimension and aged for period of not less than six months after removal from original logs.

2.03 METAL EDGE STRIPS AND STEEL STAKES:

- A. 1/4-in. by 5-inch steel plate edge strips, painted green.

- B. 16-in. tapered steel stakes.

2.04 MAT:

- A. 1/4-inch to 1/2-inch thick mat consisting of lime or silicate glass fibers with average fiber diameter to 9 microns and 2-inch to 4-inch strands of fiber bonded with phenol formaldehyde resin, 100 percent textile glass fiber, roll type, water permeable with a minimum thickness of 1/4-inch, a maximum thickness of 1/2-inch, and a density of not less than 3 pounds per cubic foot.

2.05 LOAM:

- A. Fertile, friable, natural topsoil typical of locality, without admixture of subsoil, refuse, or other foreign materials, and obtained from well-drained arable site. Mixture of sand, silt, and clay particles in equal proportions. Free of stumps, roots, heavy or stiff clay, stones larger than 1 inch in diameter, lumps, coarse sand, noxious weeds, sticks, brush, or other deleterious matter.
- B. Not less than 4 percent nor more than 20 percent organic matter as determined by loss on ignition of oven-dried samples.
- C. Six inches of topsoil, hauled to the site, shall be placed over all disturbed areas requiring seeding. Adequate topsoil is not available on site.

2.06 LIME, FERTILIZER, AND SEED:

- A. Ground agricultural limestone containing not less than 85 percent of total carbonates.
- B. Commercial type, uniform in composition, free flowing, conforming to state and federal laws, and at least 50 percent of nitrogen derived from natural organic sources of ureaform and containing following percentages by weight: Nitrogen 10 percent, Phosphorus 10 percent, Potash 10 percent.

- C. Turf grass seed, inside perimeter fence, clean, high in germinating value, grown within 150 miles of site, and latest year's crop mixture as follows:

Name	Minimum proportion by weight	Percent purity	Percent germination
Kentucky bluegrass	20%	87%	85%
Merion Kentucky bluegrass	20%	87%	85%
Red Chewings Fescue	45%	98%	85%
Manhattan rye	15%	98%	90%

- D. Weeds shall not exceed 0.25 percent.

2.07 SOD:

- A. Established, nursery grown Kentucky or Merion Bluegrass sod, vigorous, well rooted, healthy turf, free from disease, insect pests, weeds, other grasses, stones, and any other harmful or deleterious matter.
- B. Sod harvested by machine at uniform soil thickness of approximately 1 inch but not less than 3/4 of an inch. Measurement for thickness excludes top growth and thatch. Prevent tearing, breaking, drying, or any other damage.
- C. Sod may be substituted for seeding at Contractor's option.

2.08 PEAT MOSS:

- A. Shredded, loose, substantially free of mineral and waste matters.
- B. Minimum organic matter by weight on a dry basis: 80 percent.

2.09 CRUSHED STONE:

- A. Crushed stone made from light colored granite. Stone screened to insure uniformity of size. No flat, elongated stone used. Size of stone in mowing strips and other areas as indicated on drawings, conforming to following requirements:

Size of square screen	Percent passing
1-1/4 inch	95% minimum
3/4 inch	15% maximum

PART 3 - EXECUTION

3.01 PLANTING PITS:

- A. Excavate with vertical sides and in accordance with following requirements:
1. Excavate tree pits to minimum of 2 feet greater in diameter than root ball of tree and sufficiently deep to allow for 1-foot thick layer of planting soil mixture below root ball.
 2. Plant shrubs in pits 12 inches greater in width than diameter of root ball or container and minimum of 18 inches deep below finished grade, or as necessary to properly set plant at finished grade.
- B. Adjust depth of planting beds and pits to provide minimum of 8 inches of planting soil mixtures under roots of all plants.
- C. Set plants in center of pits, plumb and straight and at level that top of root ball is 1 inch lower than surrounding finished grade after settlement.
- D. Compact topsoil mixture thoroughly around base of root ball to fill all voids, when plant material is set. Cut all burlap and lacing and remove from top 1/3 of root ball. Do not pull burlap from under any root ball. Backfill tree and shrub pits halfway with planting soil mixture and thoroughly puddle before backfilling tree or shrub pit. Water tree or shrub, again, when each backfill operation is complete.

3.02 PLANTING SOIL MIXTURE:

- A. Thoroughly mix all loam used in backfilling planting pits, with peat moss at rate of 2-parts loam to 1-part peat moss, to obtain required planting soil mixture.

3.03 BONE MEAL:

- A. Add bone meal to planting mixture used for backfilling tree and shrub pits in following amounts:

Quantity (lb)	Plant size	
Shrubs*	¾	all
Minor trees	1	3'-4' hgt.
1-1/2	4'-5' hgt.	
2	5'-6' hgt.	
3	6'-8' hgt.	
5	8'-10' hgt.	
7	10'-12' hgt.	
Major trees	5	2-1/2" to 3" cal.
7	3" to 4-1/2" cal.	

*Do not apply bone meal to rhododendrons and azaleas

3.04 PLANTING:

- A. Thoroughly compact topsoil planting mixture around root balls and water. Immediately after plant pit is backfilled, form a shallow saucer slightly larger than pit with ridge of soil to facilitate and contain watering. After planting, cultivate soil in all shrub beds between shrub pits. Grub out sod or other growth and remove from bed area. Rake bed area smooth and neat and outline. Mulch all tree pits and shrub beds with a minimum of 3 inches of shredded pine bark mulch as indicated on drawings. Do not use admixture of wood chips in mulch.

3.05 BARK MULCH SURFACES:

- A. Mulch, with shredded pine bark, all tree pits, shrub pits and beds, and all areas planted with ground cover, immediately after planting operations are completed.
1. For tree and shrub pits and beds, provide a minimum 3 in. of mulch.
 2. For ground cover beds, provide a minimum 2 in. of mulch.
- B. Limit mulching for trees and individual shrubs to pit area inside of saucer and for shrub, tree and ground cover beds and panels planted with multiple trees. Define limits of beds in turf areas or where no building wall or curb exists by installed metal edging as indicated.

3.06 METAL EDGE STRIPS:

- A. Install metal edge strips around all edges of mowing strips and planting beds as indicated. Fasten metal edge strips securely in place with tapered steel stakes driven through slots punched in strip at 30-inch intervals. Set edge strips to finished grades indicated.

3.07 MOWING STRIPS AND AREAS OF CRUSHED STONE:

- A. Construct mowing strips adjacent to all exterior building and structure walls where indicated on drawings. Provide mowing strips with metal edge strips.
- B. Install mat under crushed stone and pin in place.
- C. Place 6-in. minimum layer of crushed stone between edge strip and building or structure. Consolidate stone by means satisfactory to Engineer.

3.08 LOAM:

- A. Spread loam on areas to be seeded, to required 6-inch depth, fine grade and compact.

3.09 LIME, FERTILIZER, AND SEEDING:

- A. Apply lime by mechanical means at rate of 50 pounds per 1,000 square foot.
- B. Apply fertilizer at rate of 50 pounds per 1,000 square foot.
- C. Remove weeds or replace loam and reestablish finish grades, if any delays in seeding lawn areas and weeds grow on surface or loam is washed out prior to sowing seed and without additional compensation. Sow seed at rate of 4 pounds per 1,000 square foot on calm day, by mechanical means. Do not "Hydro-Seed" unless otherwise permitted or required by Engineer. Sow one-half of seed in one direction, and other half at right angles to original direction. Rake seed lightly into loam, to depth of not more than 1/4 inch and compact by means of an acceptable lawn roller weighing 100 to 150 pounds per linear foot of width.
- D. Water lawn areas adequately at time of sowing and daily thereafter with fine spray, and continue throughout maintenance and protection period.
- E. Loam, lime, fertilize and seed required areas outside of perimeter same as lawn areas. Apply seed at rate of 80 pounds per acre. Rake seed lightly, after sowing, into top 1/4 inch of loam, and compact by suitable rollers weighing 100 to 150 pounds per linear foot of width.

3.10 SOD:

- A. Install sod not more than 48 hours after cutting. Provide lime, fertilizer, etc, preparation for sod same as stated above for seed.

3.11 CRUSHED STONE:

- A. Place crushed stone to depth of 6 inches, and thoroughly consolidate by means of suitable vibrator or mechanical tamper. Add stone, as necessary, after tamping or vibrating to finish depth of 6 inches.

3.12 CLEAN-UP:

- A. Remove soil or similar material which has been brought onto paved areas, keeping these areas clean.
- B. Upon completion of planting, remove excess soil, stones, and debris which has not previously been cleaned up and legally dispose of off-site.
- C. Prepare lawns and planting areas for final inspection.
- D. Protect slopes and embankments against erosion until work is accepted. Repair eroded portions of seeded or sodded areas by refilling, resodding, remulching, and reseeding as required by condition and to satisfaction of Engineer. Protection may be by installation of sod strips or other methods.

3.13 MAINTENANCE - SEEDED AREAS AND PLANTING:

- A. Maintain lawn areas and other seed areas at maximum height of 2-1/2 inches by mowing at least three times. Weed thoroughly once and maintain until time of final acceptance. Reseed and refertilize with original mixtures, watering or whatever is necessary to establish over entire area of lawn and other seeded areas a close stand of grasses specified, and reasonably free of weeds and undesirable coarse native grasses.
- B. Begin maintenance immediately after each planting and continue until final acceptance of work. Water, mulch, weed, prune, spray, fertilize, cultivate, and otherwise maintain and protect all plants.
- C. Reset settled plants to proper grade and position, and restore planting saucers and remove dead material. Tighten and repair guys. Correct defective work as soon as possible within guarantee period.

END OF SECTION

SECTION 02615

DUCTILE-IRON PIPE AND FITTINGS

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. Provide and test ductile-iron pipe and fittings, as indicated and specified.
- B. Provide related materials as indicated and specified.
- C. Options:
 - 1. For joints in buried exterior pipelines, provide either restrained push-on or mechanical-joint.
 - 2. For piping exposed, as in buildings and galleries, provide flanged or rigid-joint, grooved-coupled pipe and fittings.

1.02 RELATED WORK:

- A. Division 1: General Requirements
- B. Section 02210: Earth Excavation, Backfill, Fill, and Grading
- C. Section 02223: Screened Gravel
- D. Section 02224: Bank Run Gravel
- E. Section 03300: Cast-in-Place Concrete
- F. Section 15056: Pipe Supports
- G. Section 15101: Valves, Gates, Hydrants, and Appurtenances
- H. Section 15370: Miscellaneous Process Piping and Appurtenances

1.03 REFERENCES:

- A. American National Standards Institute, Inc. (ANSI) Standards:
 - 1. A21.4: Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.

2. A21.10: Ductile-Iron and Gray-Iron Fittings, 3 in. through 48 in., for Water and Other Liquids.
 3. A21.11: Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe Fittings.
 4. A21.15: Flanged Ductile-Iron Pipe with Threaded Flanges.
 5. A21.50: Thickness Design of Ductile-Iron Pipe.
 6. A21.51: Ductile-Iron Pipe, Centrifugally Cast in Metal Molds, or Sand-Lined Molds, for Water or Other Liquids.
 7. A21.53: Ductile-Iron Compact Fittings, 3-in through 16-in. for Water and Other Liquids.
 8. B16.1: Cast-Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800.
 9. B16.21: Nonmetallic Flat Gaskets for Pipe Flanges.
 10. B16.42: Ductile Iron Pipe Flanges and Flanged Fittings.
- B. American Society for Testing and Materials (ASTM) Publications:
1. A307: Carbon Steel Bolts and Studs, 60,000 psi Tensile.
 2. C283: Test Method for Resistance of Porcelain Enamelled Utensils to Boiling Acid.
 3. D1248: Polyethylene Plastics Moulding and Extrusion Materials.
- C. American Water Works Association (AWWA) Standards:
1. C606: Grooved and Shoulder Joints.
- D. Manufacturers Standardization Society of the Valve and Fittings Industry (MSS) Publications:
1. SP-58: Pipe Hangers and Supports, Materials Design and Manufacture.
 2. SP-69: Pipe Hangers and Supports Selection and Application.
- E. Steel Structures Painting Council (SSPC):
1. SP.6: Commercial Blast Cleaning.

1.04 SUBMITTALS:

- A. Shop Drawings: Submit the following in accordance with Section 01300 - SUBMITTALS:
1. Piping layouts in full detail.
 2. Location of pipe hangers and supports.
 3. Location and type of backup block or device to prevent joint separation.
 4. Large scale details of wall penetrations and special castings.
 5. Schedules of all pipe, fittings, special castings, couplings, expansion joints, and other appurtenances.
- B. Certificates: Sworn and notarized certificates in duplicate of shop tests showing compliance with appropriate standard.
- C. Manufacturer's Literature:
1. Catalog cuts of joints, couplings, harnesses, expansion joints, gaskets, fasteners, and other accessories.
 2. Brochures and technical data on coatings and lining's and proposed method of application.

1.05 QUALITY ASSURANCE:

- A. Inspect and test at foundry according to applicable standard specifications.
- B. Owner reserves right to inspect and test by independent service at manufacturer's plant or elsewhere at his own expense.
- C. Visually inspect before installation.

1.06 DELIVERY, STORAGE AND HANDLING:

- A. Provide in accordance with Section 01610.

PART 2 - PRODUCTS

2.01 PIPE:

- A. Ductile Iron:

1. Design conforming to ANSI A21.50.
2. Manufacture conforming to ANSI A21.15 or ANSI A21.51.
3. Thickness class, unless otherwise indicated or specified:
 - a. Minimum Thickness Class 52.
 - b. Minimum thickness Class 53 for use with flanged pipe.
 - c. Minimum thickness for use with grooved couplings conforming to AWWA C606 except minimum thickness Class 56 for ductile-iron pipe 18 in. and larger.

2.02 PIPE FOR USE WITH COUPLINGS:

- A. As specified above except ends shall be plain.
- B. With sleeve couplings, ends cast or machined at right angles to axis.
- C. With grooved type coupling:
 1. Ductile-Iron of thickness class specified above.
 2. Grooved End dimensions conforming to AWWA C606 for flexible or rigid joints to suit joint requirements.

2.03 FITTINGS:

- A. Provide fittings conforming to ANSI A21.10, at least Class 150.
- B. Provide bell push-on or mechanical-joint fittings, unless otherwise indicated or specified.
- C. Face and drill flanged fittings conforming to ANSI A21.10, except special drilling or tapping as necessary for correct alignment and bolting.
- D. If flanged fittings are not available under ANSI A21.10 provide fittings conforming to ANSI B16.1 in 125 lb. pressure class.
- E. Provide standard base fittings where indicated.
- F. Provide grooved-end fittings ductile-iron conforming to ANSI A21.10 (AWWA C110) for center-to-face dimensions.

1. End preparation for grooved-ends conforming to AWWA C606 for flexible or rigid joints as required by type of joint.
2. Minimum wall thickness of grooved fittings 12 inch and smaller conforming to ANSI A21.53 (AWWA C153).
3. Minimum wall thickness of grooved fittings larger than 12 inch conforming to ANSI A21.10 (AWWA C110).

2.04 WALL CASTINGS:

- A. Provide size and type indicated.
- B. Wall Castings: Conform to requirements of ANSI A21.10 or fabricate of Class 53 ductile iron pipe with screwed on flanges and welded on waterstop.
- C. Provide water stop centered in wall. Waterstop shall be minimum 1/2 inch thick by 1-1/2 inch high for pipes 12 inch and smaller, 3/4 inch thick by 2 inch high for pipes 14 inch to 24 inch and 1 inch thick by 2 inch high for pipes 30 inch and larger. Weld water stops on in factory under controlled conditions to ensure adequate strength to permit waterstop to absorb thrust up to the pressure rating of the pipe.
- D. On flanged wall castings, provide space between the wall and flange to permit mounting the nuts on the flange bolts.
- E. Locate mechanical joint wall castings with space between the bell and the wall to insert the follower bolts.
- F. Fabricated wall pipe of Schedule 40 Type 316 stainless steel may be substituted for wall castings specified above. Provide with waterstops of above dimensions and welded continuously on both sides of stop. Flanges of Type 316 stainless steel. Bolts for connection to buried pipe Type 316 stainless steel. Provide flange insulation gaskets, sleeves, and washers for all flanges.

2.05 ADAPTERS:

- A. Furnish and install for joining pipe of different types, unless solid sleeves indicated.
 1. Provide ends conforming to above specifications for appropriate type of joint, to receive adjoining pipe.
 2. Joining two (2) classes of pipe may be of lighter class provided annular space in bell-and-spigot type joints is sufficient for jointing.

2.06 JOINTS:

- A. Provide mechanical joint or restrained push-on joint pipe with necessary accessories, conforming to ANSI A21.11.
 - 1. Provide gasket composition suitable for exposure to liquid within pipe.
 - 2. Provide mechanical joint gaskets with copper tips to provide electrical continuity.
 - 3. Provide serrated brass wedges for push-on joints to provide electrical continuity; two (2) per joint for pipe 12-inch and smaller and four per joint for larger pipe.
- B. Provide pipe flanges and accessories conforming to ANSI A21.15.
 - 1. Provide flat faced flanges.
 - 2. Provide 1/8 in. thick, full faced gaskets suitable for exposure to liquid within pipe.
- C. Provide restrained joint on all buried pipe and fittings. Provide restrained joint which is:
 - 1. Pipe joints capable of being deflected.
 - 2. Designs using field welding are not acceptable.
 - 3. Manufacturers:
 - a. American Cast Iron Pipe Co. Flex-Ring.
 - b. U.S. Pipe TR FLEX.
 - c. Clow Super-Lock.
 - d. Megalug Series 1100 by EBAA Iron Inc.
 - e. Or acceptable equivalent.

2.07 SLEEVE TYPE COUPLINGS:

- A. Furnished by pipe supplier.
- B. Pressure rating at least equal to that of related pipeline.
- C. Manufactured by Dresser Mfg. Div.; Rockwell International; R. H. Baker & Co., Inc.; or acceptable equivalent product.

- D. Couplings for buried pipe: Cast iron sleeve or steel sleeve and retainer with fusion bonded epoxy coating, Dresser Style 53 or 153, Rockwell Style 431, Baker Series 228, or acceptable equivalent product. Provide couplings with Type 316 stainless steel bolts and nuts.
- E. Couplings for exposed pipe: Steel; Dresser Style 38, Rockwell Style 411, Baker Series 200, or acceptable equivalent product. Provide couplings with steel bolts and nuts.
- F. Furnish with pipe stop removed.
- G. Provide with gaskets of composition suitable for exposure to liquid within pipe.
- H. Provide gaskets with copper tips for electrical continuity through joints.

2.08 GROOVED COUPLINGS:

- A. Conform to AWWA C606.
- B. Minimum pipe wall thickness specified under "Pipe for Use with Couplings".
- C. Where grooved couplings are indicated to provide for expansion or flexibility, cut pipe grooves to provide necessary expansion or flexibility.
- D. Where grooved couplings are used instead of flanged joints, joint to be of rigid type with pipe grooves cut to bring pipe ends together. Beam strength of joint shall be equal to or greater than that of flanged joint.

2.09 FILLING RINGS:

- A. Provide where necessary.
- B. Materials, workmanship, facing, and drilling, conforming to 125-lb. ANSI Standard.
- C. Suitable length with nonparallel faces and corresponding drilling, if necessary, for correct assembly of adjoining piping or equipment.

2.10 CONNECTIONS - TAPPED:

- A. Provide watertight joint with adequate strength against pullout. Use tapered thread taps.
- B. Maximum size of taps in pipe or fittings without bosses not to exceed that listed in appropriate table of Appendix to ANSI A21.51 based on:
 - 1. Three (3) full threads for gray iron.
 - 2. Two (2) full threads for ductile iron.

- C. Where size of connection exceeds that given above for pipe, provide boss on pipe barrel or use tapping saddle. Make tap in flat part of intersection of run and branch of tee or cross, or connect by means of tapped tee, branch fitting and tapped plug or reducing flange, or tapping tee and tapping valve, as indicated or permitted.

2.11 STANDARD LINING AND COATING:

- A. Inside of pipe and fittings: Provide double thickness cement lining and bituminous seal coat conforming to ANSI A21.4.
- B. Outside of pipe and fittings within dry structures to be painted: Clean and apply one shop coat (current product equivalent) Koppers Pug Primer made by Koppers Co.; Chem-Prime 37-77 made by Tnemec Co.; or acceptable equivalent.
- C. Outside surfaces of castings to be encased in concrete: Leave bare, do not use coating.
- D. Machined surfaces cleaned and coated with suitable rust-preventative compound at shop.
- E. Outside of other pipe and fittings: Standard bituminous coating conforming to appropriate AN Standard.

2.12 GASKETS, BOLTS, AND NUTS:

- A. Provide ring rubber gaskets with cloth insertion for flanged joints, neoprene faced phenolic for insulating gaskets.
 - 1. Gaskets 12 inches (12") in diameter and smaller, 1/16 inch thick.
 - 2. Larger than 12 inches (12") in diameter, 1/8 inch thick.
- B. Make flanged joints with:
 - 1. Bolts.
 - 2. Bolt studs with nut on each end.
 - 3. Studs with nuts where flange is tapped.
 - 4. Plastic bolt sleeves and washers for insulating joints.
- C. Number and size of bolts conform to same ANS as flanges.
- D. Provide bolts and nuts, except as specified or indicated, Grade B, ASTM A307.
- E. Provide bolt studs and studs of same quality as machine bolts.

F. Flanged joints for wall castings flush with masonry made up with Type 316 stainless steel stud bolts and nuts.

G. Submerged flanged joints made up with Type 316 stainless steel bolts and nuts.

2.13 PAINTING:

A. Provide shop coats specified under Standard Lining and Coating.

B. Coat pipe hangers and supports with one shop coat of rust inhibitive primer. Stainless steel hangers and supports shall not be painted.

PART 3 - EXECUTION

3.01 INSPECTION BEFORE INSTALLATION:

A. Visually inspect.

3.02 HANDLING AND CUTTING:

A. Mark pipe and fittings "Rejected" and remove from site when cracked or has received a severe blow.

B. If permitted, cut on sound barrel at a point at least 12 in. from visible limit of crack, at Contractor's expense.

C. Machine cut with milling type cutters, knives, or saws. Snap cutters, torch, or hammer and chisel NOT ALLOWED. Examine for possible cracks.

D. Chamfer cut ends if used for push-on joints.

3.03 INSTALLATION:

A. Piping Support:

1. Furnish and install supports to hold piping at lines and grades indicated.
2. Support pipe and appurtenances connected to equipment to prevent any strain imposed on equipment.
3. Support piping within buildings and structures from floors, walls, ceilings or beams. For floor support, use saddle stands or concrete or brick piers as indicated or permitted. Shape pipe saddles to fit pipe and be capable of screw adjustment. Construct brick and concrete piers to conform accurately to the bottom one-third to

one-half of pipe. Support piping along walls by wall brackets with attached pipe rolls, saddles or with adjustable hanger rods. Support piping from ceilings with rod hangers of type capable of screw adjustment and with adjustable concrete inserts or beam clamps.

4. Use hangers and supports conforming to MSS-SP-58.
5. Place supports to provide uniform slopes without sagging. Locate per MSS-SP-69 with at least two hangers for each pipe section. Locate hangers adjacent to joints, direction changes, and branch connections.
6. Back up bends, tees, and other fittings in pipelines buried in ground with Class B concrete placed against undisturbed earth. If soil does not provide firm support, provide bridle rods, clamps, and accessories to brace fitting properly. Coat bridle rods, clamps, and accessories with two coats of an acceptable bituminous paint after assembly.

B. Pipe and Fittings:

1. Remove and replace defective pieces.
2. Clear of all debris and dirt before installing and keep clean until accepted.
3. Lay accurately to lines and grades indicated or required. Provide accurate alignment, both horizontally and vertically.
4. Provide firm bearing along entire length of buried pipelines.
5. Do not allow deflection of alignment at joints to exceed permissible deflection as specified below; discuss with Owner using a set of fittings where needed (project requires one set of 11-1/4 MJ bends and one set of 22-1/2 MJ bends in 10" dia.):

PIPE DEFLECTION ALLOWANCES

Maximum permissible deflection, in.*

Size of pipe, in	Push-on joint	Mechanical joint
4	19	31
6	19	27
8	19	20
10	19	20
12	19	20
14	11	13-1/2
16	11	13-1/2
18	11	11
20	11	11
24	11	9

* Maximum permissible deflection for 20-ft. lengths; for other lengths in proportion.

- a. For mechanical joint, push-on joint, or similar pipe, clean bell of excess tar or other obstruction and wipe out before inserting next pipe spigot. Shove new pipe into place until properly seated and hold securely until joint is completed.
 - b. Set castings to be encased in concrete accurately with bolt holes, if any, carefully aligned. Clean off rust and scale before setting.
- C. Temporary Plugs: When pipe laying not in progress, close open ends of pipe with temporary watertight plugs. If water in trench, do not remove plug until danger of water entering pipe passes.
- D. Socket Pipe Clamps, Tierods, and Bridles: Where indicated or necessary to prevent joints or sleeve couplings from pulling apart under pressure, provide suitable socket pipe clamps, tierods, and bridles. Use bridles and tierod at least 3/4 inch in diameter except where they replace flange bolts of smaller size with nut on each side of flange pairs. Coat clamps and tierods or bridles with two coats of bituminous coating after assembly and let dry before backfilling.
- E. Appurtenances: Set valves, fittings, and appurtenances as indicated.

3.04 JOINTS AND COUPLINGS:

A. Push-on Joints:

1. Insert gasket into groove bell. Apply thin film of nontoxic gasket lubricant over inner surface of gasket in contact with spigot end.
2. Insert chamfered end into gasket. Force pipe past it until it seats against socket bottom.

B. Bolted Joints:

1. Remove rust-preventive coatings from machined surfaces.
2. Clean pipe ends, sockets, sleeves, housings, and gaskets and smooth all burrs and other defects.

3. Use torque wrench to tighten to correct range of torque not to exceed values specified below:

TORQUE RANGE VALUES

Nominal pipe size, in	Bolt diameter, in	Range of torque, ft-lb
3	5/8	40-60
4-24, incl.	3/4	75-90
30, 36	1	100-120
42, 48	1-1/4	120-150

C. Flanged Joint:

1. Make up tight.
2. Do not put strain on nozzles, valves, and other equipment.

D. Mechanical Joints:

1. Wire brush surfaces in contact with gasket and clean gasket.
2. Lubricate gasket, bell, and spigot with soapy water.
3. Slip gland and gasket over spigot, and insert spigot into bell until seated.
4. Seat gasket and press gland firmly against gasket.
5. After bolts inserted and nuts made finger-tight, tighten diametrically opposite nuts progressively and uniformly around joint by torque wrench. Torque bolts to values specified above.

E. Sleeve-Type Coupling:

1. Clean pipe ends for distance of 8 inches.
2. Use soapy water as gasket lubricant.
3. Slip follower and gasket over each pipe to a distance of 6 inches from end and place middle ring on pipe end until centered over joint.
4. Insert other pipe end into middle ring and bring to proper position in relation to pipe laid.

5. Press gaskets and followers into middle ring flares.
6. After bolts inserted and nuts made finger tight, tighten diametrically opposite nuts by use of torque wrench of size and torque specified below:

TORQUE

Nominal pipe size, in	Bolt diameter, in	Range of torque, ft-lb
3-24	5/8	75
30-36 (1/2 in. mid ring)	5/8	65
30-36 (3/8 in. mid ring)	5/8	70
30-48	3/4	80
48-72	3/4	70

7. After assembly and inspection and before backfill, coat exterior surfaces of buried couplings with heavy-bodied bituminous mastic.

F. Grooved Couplings:

1. Clean grooves and other parts.
2. Coat ends of pipe and outside of gasket with soft soap or silicone and slip gasket over one pipe end.
3. Bring pipes to correct position and center gasket over pipe ends with lips against pipe.
4. Place housing sections, insert bolts, and tighten nuts until housing sections in metal-to-metal contact.
5. After assembly and inspection and before backfilling, coat exterior surfaces of buried couplings, including bolts and nuts, with heavy-bodied bituminous mastic.

G. Tapped Connection:

1. Drill and tap normal to longitudinal axis.
2. Drilled by skilled mechanics using proper tools.
3. Use only tapered threads.

H. Electrical Conductors:

1. Install pipes so terminal strips are aligned.

2. Install jumper strips and tighten bolts.

3.05 TESTING:

- A. Clean of all dirt, dust, oil, grease, and other foreign material, before conducting pressure and leakage tests.

- B. Pressure and Leakage Tests:

1. Conduct combined pressure and leakage test in pipelines.
2. Furnish and install temporary testing plugs or caps; pressure pumps, pipe connections, meters, gages, equipment, and labor.
3. Test when desired and comply with specifications.
4. Test pipelines in excavation or embedded in concrete before backfill or placing of concrete and test exposed piping before field painting.
5. Fill section of pipe with water and expel air. If hydrants or blow-offs are not available at high points for releasing air, make necessary taps and plug after test completion.
6. Maintain section full of water for 24 hours before conducting combined pressure and leakage test.
7. Conduct pressure and leakage test consisting of first raising water pressure (based on elevation of lowest point of section under test and corrected to gage location) to pressure in psi numerically equal to pipe pressure rating, but not more than 100 psi.
8. If unable to achieve and maintain specified pressure for one hour with no additional pumping, section fails test.
9. If section fails pressure and leakage test, locate, uncover, and repair or replace defective pipe, fitting, or joint, at no additional expense and without time extension. Conduct additional tests and repairs until section passes test.
10. Modify test procedure only if permitted by Engineer.

3.06 PAINTING:

- A. Field painting, per Standard Lining and Coating.

END OF SECTION

Not to be used for bidding purposes

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SCOPE:

- A. This section covers all cast-in-place concrete, including reinforcing steel, forms, finishing, curing, and appurtenant work.

1.02 SUBMITTALS:

- A. All submittals of drawings and data shall be in accordance with the Submittals Procedures section.

PART 2 - PRODUCTS

2.01 LIMITING REQUIREMENTS:

- A. Unless otherwise specified, concrete shall be controlled within the following limiting requirements:

Cement Content	At least 564 lbs per cubic yard, Type II.
Maximum Water-Cement Ratio	The maximum water-cement ratio shall be 0.42 on a weight basis, or, if fly ash is used, the combined mass of cement plus fly ash shall be used to determine the water-cementitious materials ratio.
Fly Ash Content	At the option of Contractor, fly ash may be substituted for up to 25 percent of the Portland cement, on the basis of 1.0 lbs of fly ash added for each lb of cement reduction.
Concrete Strength	4,500 psi minimum compressive strength at 28 days.
Air Content	6 percent \pm 1.5 percent.
Coarse Aggregate	Maximum nominal coarse aggregate size, 1 inch.

Admixtures	A water-reducing admixture and an air-entraining admixture shall be included in all concrete. No calcium chloride or admixture containing chloride from sources other than impurities in admixture ingredients will be acceptable.
Consistency	Workable, without segregation, with slump not more than 4 inches when concrete is placed.
Mixing	In accordance with ASTM C94.

B. Slump: Concrete slump shall be kept as low as possible consistent with proper handling and thorough compaction. Unless otherwise authorized by Engineer, slump of concrete without superplasticizer shall not exceed 4 inches. Slump of concrete with superplasticizer or midrange water reducer shall not exceed 8 inches.

C. Total Air Content. The total volumetric air content of concrete after placement shall be 6 percent \pm 1.5 percent. Air-entraining admixture may be omitted from concrete for interior slabs which are to be trowel finished.

D. Admixtures. The admixture content, batching method, and time of introduction to the mix shall be in accordance with the manufacturer's recommendations and acceptable to Engineer. A water-reducing admixture and an air-entraining admixture shall be included in all concrete. A midrange water reducer or a superplasticizer may be used at Contractor's option. No calcium chloride or admixture containing chloride from sources other than impurities in admixture ingredients will be acceptable.

E. Strength. The minimum acceptable compressive strengths, as determined by ASTM C39, shall be:

Age	Minimum Compressive Strength
Seven (7) days	3,375 psi
Twenty-eight (28) days	4,500 psi

Cylinders shall be 6 inches diameter by 12 inches high for concrete mixes using a maximum nominal aggregate size of 1 inch or larger. Cylinders may be either 6 inches diameter by 12 inches high, or 4 inches diameter by 8 inches high for concrete mixes using a maximum nominal aggregate size of less than 1 inch. The average compressive strength shall be determined from the results of at least three (3) cylinders when using 4-inch (4") diameter cylinders, and at least two (2)

cylinders when using 6-inch (6”) diameter cylinders. All tests shall be performed using the same sized cylinders for the duration of the work.

2.02 MATERIALS:

Cement	ASTM C150, Type II, low alkali.
Fly Ash	ASTM C618, Class F or Class C, except loss on ignition shall not exceed 4 percent.
Fine Aggregate	Non-reactive, clean, natural sand, ASTM C33.
Coarse Aggregate	Non-reactive crushed rock, washed gravel, or other inert granular material conforming to ASTM C33, class 4S, except that clay and shale particles shall not exceed 1 percent.
Water	Potable.
Admixtures	
Water-Reducing	ASTM C494, Type A or D.
Air-Entraining	ASTM C260.
Superplasticizing	ASTM C494, Type F or G.
Reinforcing Steel	
Bars	ASTM A615, Grade 60, deformed.
Welded Wire Fabric	ASTM A185 or A497.
Bar Supports	CRSI Class 1, plastic protected; or Class 2, stainless steel protected.
Mechanical Connector, Splices	Mechanical lap splice per ACI 318 Chapter 12. Develops at least 125% of specified yield in ASTM A615 Grade 60 deformed bars. Use only where indicated on the drawings.
Expandable Waterstops, permitted only at locations indicated on Drawings	Hydrophilic; bentonite free, chemically modified rubber. Adeka “Ultra Seal MC-2010MN” or Greenstreak “Hydrotite CJ-1020-2K”. Adhesive as recommended by the manufacturer.

Sealant for expandable waterstop	Adeka "Ultra Seal P-201" or Greenstreak "Leakmaster".
Expansion Joint Material	Sponge rubber expansion joint material, ASTM D1752 Type I, as indicated on the drawings.
Forms	
Plywood Product	Standard PS1, waterproof, resin-bonded, exterior type, Douglas fir.
Lumber	Straight, uniform width and thickness, and free from knots, offsets, holes, dents, and other surface defects.
Form Coating	Nonstaining and nontoxic after 30 days. Product shall not exceed VOC limits established by the federal, state, or local regulatory agency having jurisdiction over the project site.
Evaporation Reducer	Dayton Superior "AquaFilm Concentrate J74", Euclid "Eucobar", L&M Chemical "E-Con", BASF "Confilm", or Sika "SikaFilm".
Membrane Curing Compound and Floor Sealer	ASTM C1315, Type I, Class A, minimum 25 percent solids, acrylic, non-yellowing, unit moisture loss 0.40 kg/m ² maximum in 72 hours. Product shall not exceed VOC limits established by federal, state, or local regulatory agency having jurisdiction over the project site.
Polyethylene Film	Product Standard PS17 or ASTM D4397, 6 mils

2.03 PRELIMINARY REVIEW:

- A. Reports covering the source and quality of concrete materials and the concrete proportions proposed for the work shall be submitted to Engineer for review before any concrete is placed.

2.04 FORMS:

- A. Forms shall be designed to produce hardened concrete having the shape, lines, and dimensions indicated on the drawings. Forms shall be substantial and sufficiently tight to prevent leakage of mortar and shall be maintained in proper position and accurate alignment. Forms shall be thoroughly cleaned and coated before concrete is placed and shall not be removed until the concrete has attained sufficient strength to safely support all loads without damage.

2.05 REINFORCEMENT:

- A. Reinforcement shall be accurately formed and positioned, and shall be maintained in proper position while the concrete is being placed and compacted. Reinforcement shall be free from dirt, loose rust, scale, and contaminants. Mechanical connectors (Double Barrel Zap Screwlok by BarSplice Products Inc. or equal) shall be used only as indicated on the drawings and installed in conformance with manufacturer's published instructions.
- B. Provide the following minimum reinforcing bar lap splices for 4,500 psi concrete and $F_y = 60,000$ psi for the reinforcing steel.

BAR SIZE	LAP SPLICE LENGTH (INCHES)
#4	20
#5	26
#6	30

- a. These lap splice dimensions are based on at least 2" concrete cover over the bars and at least 4" spacing between bars.
- b. Consult Engineer if any of these conditions can't be maintained.

2.06 Concrete Patching Mortar

- A. Concrete slab patching that is 2" or less in thickness shall use the following products:
 - a. MasterEmaco S 466CI
 - b. ThoRoc LA40 Repair Mortar
- B. Bonding agent, recommended by the selected patching mortar manufacturer, shall be utilized for all concrete repairs.
- C. Preparation and installation shall adhere to the manufacturer's printed instructions, unless otherwise required."

PART 3 - EXECUTION

3.01 PLACEMENT:

- A. Concrete shall be conveyed to the point of final deposit and placed by methods which will prevent segregation or loss of the ingredients. During and immediately after placement, concrete shall be thoroughly compacted and worked around all reinforcement and embedments and into the corners of the forms. Unless otherwise authorized, compaction shall be by immersion-type vibrators. The use of "jitterbug" tampers to compact concrete flatwork will not be permitted.

- B. Polyethylene Film. Where concrete is placed against gravel or crushed rock which does not contain at least 25 percent (25%) material passing a No. 4 sieve, such surfaces shall be covered with polyethylene film. Joints in the film shall be lapped at least four (4) inches and taped.

3.02 WATER STOPS:

- A. Each water stop shall be continuous throughout the length of the joint in which it is installed. Water stops shall be clean, free from coatings, and shall be maintained in proper position until surrounding concrete has been deposited and compacted.

3.03 FINISHING:

- A. Fins and other surface projections shall be removed from all formed surfaces, except exterior surfaces that will be in contact with earth backfill. Surface voids and recesses resulting from removal of form ties shall be filled with mortar. Unless otherwise specified, unformed surfaces shall be given a float finish and deck surfaces shall be broom finished for texture.

- B. Application of Evaporation Reducer.

1. Concrete flatwork subject to rapid evaporation due to hot weather, drying winds, and sunlight may be protected with an evaporation reducer. The evaporation reducer shall form a continuous film on the surface of fresh, plastic concrete to reduce evaporation.
2. Immediately following screeding, evaporation reducer shall be sprayed over the entire surface of fresh, plastic concrete flatwork at a rate of not less than 200 square feet per gallon, in accordance with the manufacturer's recommendations. The spray equipment shall have sufficient capacity to continuously spray the product at approximately 40 psi with a suitable nozzle as recommended by the manufacturer.
3. The sprayable solution shall be prepared as recommended by the manufacturer.
4. Under severe drying conditions, additional applications of evaporation reducer may be required following each floating or troweling, except the last finishing operation.

- C. Sidewalks.

1. Concrete surfaces shall be screeded to the proper elevation and contour. All aggregates shall be completely embedded in mortar. Screeded surfaces shall be given an initial float finish as soon as the concrete has stiffened sufficiently for proper working. Any piece of coarse aggregate which is disturbed by the float or which causes a surface irregularity shall be removed and replaced with mortar. Initial floating shall produce a surface of uniform texture and appearance, with no unnecessary working of the surface. Initial floating shall be followed by a second floating at the time of initial set.

2. Floated surfaces shall be given a light broom finish, using a horsehair broom, to provide a nonslip surface. Brooming shall be done at right angles to the length of the walk.
3. Sidewalks shall be edged using a 3- or 4-inch wide edging tool with a 1/8 inch corner radius. Edger lap marks at corners of each slab shall be carefully removed. False joints shall be provided at right angles to the length of the walk, using a grooving tool with 1/8 inch radius. The finished edge on each side of the joint shall be the same width as the edging tool used. False joints shall divide each sidewalk into square sections.
4. The finished surface of all sidewalks shall be neat in appearance, shall be sloped to drain, and shall not pond water.

D. Curb and Gutter.

1. Concrete Curb and gutter shall be finished to the shape indicated on the drawings. After the forms have been removed, all exposed edges shall be rounded, using an edging tool with a 1/8 inch corner radius. Exposed surfaces shall be float finished and given a light broom finish applied at right angles to the curb at the time of initial set, using a horsehair broom.

3.04 CURING:

- A. Concrete shall be protected from loss of moisture for at least 7 days by membrane curing or by water curing. Membrane curing compound shall be applied as recommended by the manufacturer. Water curing shall be per with ACI 308.1.
- B. Keep concrete moist and at an average daily temperature of at least 50 degrees Fahrenheit, for at least seven (7) days following placement. If hourly temperature is allowed to drop below 50 degrees Fahrenheit during the seven (7) days after placement, the cure time shall be extended to compensate for the cold and shall be per the Engineer's request.

3.05 COLD WEATHER CONCRETING:

- A. Concrete work during cold weather shall be in accordance with the recommendations of ACI 306R and as indicated herein.
- B. Submit a cold weather concreting plan for approval. The plan shall address all aspects of the process including batch plant activities, delivery, placement, curing, freeze protection, temperature monitoring, and recording of data.
- C. Subgrade and steel shall be heated to at least 40 degrees Fahrenheit and maintained at this temperature until arrival of concrete. Placement over frozen subgrade is not acceptable.
- D. Heat water and aggregate at the batch plant so concrete arrives on site at least at 55 degrees Fahrenheit.

- E. Accelerating admixtures are not acceptable.
- F. Maintain surface of fresh concrete above 50 degrees Fahrenheit for at least seven (7) days.
- G. Contractor shall record temperatures of concrete off the truck and at multiple locations on each pour. Record temperatures first thing in the morning, at noon, and at end of the work day during the first ten (10) days after pouring. Recording on weekends and holidays is not required. Keep records and submit to Engineer within fourteen (14) days of concrete placement.

3.06 HOT WEATHER CONCRETING:

- A. Concrete work during hot weather shall be in accordance with the recommendations of ACI 305R and as indicated herein.
- B. Submit a hot weather concreting plan for approval. The plan shall address all aspects of the process including batch plant activities, delivery, placement, and curing.
- C. Cool surfaces of subgrade and reinforcing steel and inserts to approximately 90 degrees Fahrenheit prior to concrete placement. Provide shelter as necessary to shade the concrete area from direct sun and wind.
- D. Temperature of delivered concrete shall not exceed 90 degrees Fahrenheit. Water addition to the mix on site for cooling purposes is not an acceptable method of cooling the mix.
- E. Keep placed concrete continuously moist for at least twenty-four (24) hours following placement. Following curing procedures.

3.07 REPAIRING DEFECTIVE CONCRETE:

- A. Defects in concrete surfaces shall be repaired to the satisfaction of Engineer. All concrete which is honeycombed or otherwise defective shall be cut out and removed to sound concrete, with edges cut square to avoid feathering.
- B. Concrete repair work shall conform to Article 5.3.7 of ACI 301 and shall be performed in a manner that will not interfere with thorough curing of surrounding concrete. Repair work shall be adequately cured.

3.08 OWNER'S FIELD CONTROL TESTING:

- A. Field control tests shall be performed by Engineer or Owner's testing laboratory personnel, at the expense of Owner. Contractor shall provide access to all facilities and the services of one or more employees as necessary to assist with the field control testing.
1. Air Content. An air content test shall be made on concrete from each batch of concrete from which concrete compression test cylinders are made. Air content shall be determined in accordance with ASTM C231.
 2. Slump. A slump test shall be made on concrete from each batch of concrete from which concrete compression test cylinders are made. Slump shall be determined in accordance with ASTM C143.
 3. Test Cylinders. Compression test specimens shall be made, cured, stored, and delivered to the laboratory in accordance with ASTM C31 and C39. Compressive strength tests will be evaluated in accordance with ACI 318 and as specified herein.
 4. One set of concrete test cylinders shall be cast for each concrete pour. A set of test cylinders shall consist of four six inch diameter cylinders. One cylinder shall be tested at seven (7) days, and two shall be tested at twenty-eight (28) days. The fourth shall be retained in the event an additional break is necessary. All concrete required for testing shall be furnished by, and at the expense of, Contractor.

END OF SECTION

Section 05530

GRATING

PART 1 - GENERAL

1-1. SCOPE. This section covers the fabrication and installation of metal grating to replace existing concrete planks at two of the pump house drain structures.

1-2. SUBMITTALS. Detailed fabrication and erection drawings covering the grating shall be submitted in accordance with the Submittals Procedures sections. Drawings shall indicate locations of grating supports, profiles, thicknesses, lengths, markings of panels, and fastening methods.

1-3. DELIVERY, STORAGE, AND HANDLING. Materials shall be handled, transported, and delivered in a manner which will prevent bends, dents, scratches, or damage of any kind. Damaged materials shall be promptly replaced. Materials shall be stored off the ground.

PART 2 - PRODUCTS

2-1. PERFORMANCE AND DESIGN REQUIREMENTS.

2-1.01. Design Criteria. Except as modified herein, the manufacture and fabrication of metal grating shall comply with recommendations in the "Metal Bar Grating Manual" of the National Association of Architectural Metal Manufacturers (NAAMM). Grating depth shall be as indicated on the Drawings.

Grating shall be designed and fabricated to support 100 psf live load with a maximum deflection not greater than $L/150$ or 1/4 inch, unless indicated otherwise on the Drawings.

All grating shall have a slip resistant surface, such as serrations on the top walking surface bars.

2-1.02. Carbon Steel Grating. Carbon steel grating shall be the welded type. Bearing bars shall be at least 3/16 inch thick with center-to-center spacing of 1-3/16 inch. Grating shall be galvanized.

2-1.03. Aluminum Grating. Aluminum grating shall be the pressure locked type, with cross bars deformed or swaged to prevent turning. Bearing bars shall be at least 3/16 inch thick flat stock or equivalent I-bars, with center-to-center spacing of 1-3/16 inches. Cross bar center-to-center spacing shall be 4 inches maximum. Grating shall be a mill finish.

2-2. MATERIALS.

Carbon Steel Grating	NAAMM MBG 531, ASTM A1011, rectangular, welded, galvanized after fabrication.
Galvanizing	ASTM A123, A153, A385; G90 coating.
Aluminum Grating	NAAMM MBG 531, ASTM B221, 6063-T6 or 6061-T6 alloy, pressure or swage locked, mill finish
Grating Stair Treads	Grating stair treads shall match the material and finish of grating in adjacent platforms and floors. Treads shall have a permanently attached or integral non-skid nosing.
Grating Fasteners	Manufacturer's standard, AISI Type 316 stainless steel.
Clips, Bolts, Nuts, Washers	Manufacturer's standard, AISI Type 316 stainless steel.
Welded Threaded Steel Studs	ASTM A108 fully threaded studs automatically welded with compatible nuts and washers; TRW Nelson Type CFL or acceptable equal.
Stepped Locking Fasteners	Non-penetrating, non-welded mechanical fasteners, with stainless steel clips and bolts, galvanized cast iron body; Lindapter "Grate-Fast" or Grating Specialty Co. "G-Clip".

2-3. FABRICATION. Grating shall be fabricated in panels that can be easily handled by plant personnel. Unless otherwise indicated on the Drawings, the weight of individual panels shall not exceed 150 lbs. Panels shall be within $\pm 1/4$ inch of authorized length and $\pm 1/4$ inch of authorized width, and shall have a maximum difference in length of opposite diagonals of $1/4$ inch. The spacing of bearing bars shall be within $1/32$ inch of authorized spacing. Cross bars and edge bars of adjacent panels shall align. After installation, there shall be not more than $1/4$ inch clearance between panels. All bearing bars shall be parallel. Bands and toeplates shall align within $1/8$ inch tolerance, vertical and horizontal.

Angular, circular, and re-entrant cuts in steel grating may be made by flame cutting. All other cuts in steel grating shall be sawed or sheared. Cuts shall be clean and smooth, without fins, beads, or other projections. Any damaged protective coating shall be fully restored.

All cuts in aluminum grating shall be sawed or sheared.

Grating panels shall be arranged so that openings are centered on a joint between panels. Toeplates extending the full depth of the grating and 4 inches above the top shall be provided around openings. Toeplates shall be welded to each bearing bar. The ends of bearing bars need not be banded unless required by the Drawings. Bands shall be welded to the first, the last, and every fourth intermediate bar. Bands and toeplates shall be 3/16 inch thick. Crossbars shall be cut off flush with the outside face of side bars.

Steel frames anchored to existing supports or cast in concrete to support grating shall be stainless steel or hot-dip galvanized after fabrication. The existing concrete planks are 4-1/2" deep. The new grating support frame shall consist of a tube welded to form a rectangular in shape frame. The existing openings shall be field measured for each of the two openings. The frame's tube sections shall be 2-1/2" x 2-1/2" x 1/4" with full circumference welds at each corner to form the single piece rigid frame.

2-4. SHOP COATING. Finish painting of grating, if required, is covered in the protective coatings section.

2-4.01. Galvanizing. All galvanizing shall be done by the hot-dip process after fabrication, in conformity with the requirements of ASTM A123, A153, and A385.

2-4.02. Aluminum. All surfaces of aluminum which will be in contact with concrete, mortar, or dissimilar metals shall be given a coat of epoxy enamel on the contact surfaces.

PART 3 - EXECUTION

3-1. GENERAL. After removal of the concrete planks, the existing support frame shall be thoroughly cleaned and field coated with a zinc rich primer. All grating shall lie flat, with no tendency to rock when installed. Poorly fitting or damaged grating shall be rejected. Grating openings may be field cut with the approval of Engineer, provided that no more than four adjacent bearing bars are cut. If the grating is cut or modified in the field, affected surfaces shall be repaired or sealed to assure restoration of the corrosion resistance of the grating. Field cut openings must be spaced so that there are at least as many continuous bars between each opening as there are cut bars at the opening.

3-2. ATTACHMENTS TO SUPPORTING STRUCTURE. All grating supported on steel, aluminum, or fiberglass structures shall be attached. Grating shall be attached to the supporting structure in accordance with the grating manufacturer's recommendations and submittals. Single span grating over flumes, manholes, pits, or other openings in concrete floors may rest unattached in recesses constructed for that purpose. To preclude excessive accumulation of tolerances, an extra-long panel shall be provided for each unanchored grating cover that exceeds 20 feet in length. The panel shall be cut to the required dimension after the remainder of the grating panels have been installed.

3-2.01. Prime Painted Steel Supports. Unless otherwise required or indicated on the Drawings, clip or flange block fasteners or stepped locking fasteners shall be used to attach grating to prime painted steel supports. Clip fasteners shall be secured to the supporting steel with through bolts in drilled holes. Through bolts shall be stainless steel. Fusion welded threaded studs may be utilized if the primer is removed before welding or if a suitable weldable primer is used. Welded studs shall be cleaned and prime painted to match the support steel prior to finish painting.

3-2.02. Galvanized Steel Supports. Unless otherwise indicated on the Drawings, stepped locking fasteners shall be used to attach grating to galvanized steel supports. The galvanized coating shall not be damaged.

3-2.03. Stainless Steel and Aluminum Supports. Unless indicated otherwise on the Drawings, clip or flange block fasteners or stepped locking fasteners shall be used to attach grating to stainless steel or aluminum supports. Fasteners shall be secured to the supporting structure with stainless steel through bolts in drilled holes. Welded fasteners shall not be used.

3-3. FINISH TOUCHUP. After erection, all grating shall be cleaned. Damaged coatings shall be touched up in accordance with the grating manufacturer's recommendations to fully restore the corrosion resistance of the grating.

End of Section

SECTION 15056

PIPE SUPPORTS

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. Provide a complete system of pipe supports with necessary inserts, bolts, nuts, restraining and hanger rods, washers, miscellaneous steel, and accessories as indicated and specified.
 - 1. Design and provide all support systems for piping, except where supports are specifically designed and shown on the drawings.
 - 2. Design and provide all temporary pipe supports required during construction.

1.02 RELATED WORK:

- A. Division 1: General Requirements
- B. Section 02615: Ductile Iron Pipe and Fittings
- C. Section 03300: Cast-in-Place Concrete
- D. Section 15370: Process Pipe and Appurtenances

1.03 REFERENCES:

- A. American Institute of Steel Construction (AISC) Manual for Steel Construction.
- B. American Society for Testing and Materials (ASTM) Publications:
 - 1. A36: Specification for Structural Steel.
A500 GR B Tube Steel.
 - 2. E165: Practice for Liquid Penetrant Inspection Method.
 - 3. E709: Practice for Magnetic Particle Examination.
 - 4. A307: Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.
 - 5. A312: Type TP304L stainless steel.
 - 6. A572: Specification for Steel Plate.

C. American National Standards Institute (ANSI):

1. B31.1: Power Piping Code.

D. American Welding Society (AWS) Code:

1. A2.0: Structural Welding Code D1-1-7.

E. Manufacturer's Standardization Society (MSS):

1. MSS SP-58: Pipe Hangers and Supports - Materials and Design.

2. MSS SP-69: Pipe Hangers and Supports - Selection and Application.

3. MSS SP-89: Pipe Hangers and Supports - Fabrication and Installation Practices.

F. National Association of Expansion Joint Manufacturers.

1.04 DEFINITIONS:

A. Anchor: Unless modified by the words "moment resisting", an anchor is understood to transmit only axial forces to the structures.

B. Guide: Transmits radial loads to the structure, and permits axial movement.

C. Hanger: Use where pipe loads are supported from above.

D. Support: Usually refers to devices transmitting pipe loads to structure located below the pipe, such as piers and stanchions. Broadly refers all devices for carrying pipe loads.

E. Support Element: There are three categories:

1. Structural attachment, such as welded beam clips, beam clamps, plate bolted to concrete, concrete insert, or other device for transmitting support loads to the structure.

2. Pipe wall attachments, such as clevises, clamps, U-bolts, insulated shoes, etc. which are in contact with the pipe itself.

3. Support components, exclusive of above, such as spring cans, rods, turnbuckles, miscellaneous steel, nuts and bolts that join the structural attachment to the pipe wall attachment.

1.05 SUBMITTALS:

A. Shop Drawings: Submit the following in accordance with Section 01300 - SUBMITTALS:

1. Shop and erection drawings stamped and signed by a Professional Engineer registered in Illinois.
2. Shop drawing data for accessory items.
3. Prior to fabrication, submit a copy of the Contractors piping drawing indicating location of pipe supports, identified by hanger mark numbers.
4. Pipe support drawings specified in paragraph 2.03 B, prior to fabrication.
 - a. Indicate all welds, both shop and field, by Standard Symbols as specified in AWS D1.1-1.7.
5. Pipe stress analysis performed prior to pipe support design.
6. Welding Procedure: Submit description as required to illustrate each welding procedure to be performed in the specified work.
7. Welding Equipment: Submit descriptive data for welding equipment, including type, voltage and amperage.
8. Qualification for Welders: Provide certification that welders to be employed in work have satisfactorily passed AWS qualification tests. If recertification of welders is required, retesting is the Contractor's responsibility at no additional cost to the Owner.
9. Pipe support manufacturer's qualifications as specified in paragraph 1.06.D herein.
 - a. List of at least five (5) successful pipe support projects and current addresses and telephone numbers of persons in charge of representing the owner or the owner of those construction projects during the time of pipe support design and installation.
 - b. Qualifications of manufacturer's Registered Professional Engineer who stamps and seals shop drawings and designs.

1.06 QUALITY ASSURANCE:

- A. Pipe supports: Conform to the requirements of Manufacturers Standardization Society; MSS-SP-58, MSS-SP-69, MSS-SP-89 and paragraphs 120 and 121 of ANSI B31.1 and as specified and indicated.
- B. Structural concrete designs: Conform to the requirements of Section 03300. Concrete strength: 4,500 PSI unless noted otherwise.
- C. Conform to the requirements of AISC Manual for Steel Construction for miscellaneous steel and supplementary steel. Tube steels are A500 Grade B, wide flange A-36, Plates A-572 or equal. Stainless steel structural members to conform to ASTM requirements for T-304 or T-316 as indicated.
- D. Pipe Support Manufacturer Qualifications:
 - 1. Fabricator must submit a written quality assurance program.
 - 2. Have a minimum of 5-years experience in the design of pipe supports.
 - 3. Have completed at least 5 successful pipe support projects of equal size, complexity, and systems as project specified and indicated.
 - 4. Retain the services of a Professional Engineer Registered in Illinois with a minimum of 10-years experience in the design of pipe supports.

1.07 DELIVERY, STORAGE, AND HANDLING:

- A. Provide in accordance with Section 01610.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

- A. Anvil International
- B. Bergen-Paterson.
- C. Carpenter-Paterson.
- D. Or an acceptable equivalent product.

2.02 MATERIALS:

- A. Provide materials used in pipe supports compatible with pipes to which they are attached.
- B. Allowable materials: As indicated in ANSI B31.1 Appendix A and MSS-SP-58 Table 2.
- C. Provide Type 316L stainless steel for pipe supports, hangers, guides, restraints, and anchors that are submerged, in wetted areas in channels, or in chemically corrosive atmospheres.
- D. Provide only new material. Previously used and/or scrap material is not acceptable.
- E. Provide tube steels that are A500 Grade B, wide flange A-36, Plates A-572, or equal.

2.03 DESIGN OF PIPE SUPPORTS:

- A. Location of pipe supports: As indicated for piping 30-inch and larger. 24-inch and smaller is the responsibility of the Contractor.
- B. Provide detailed drawings of each pipe support. Each drawing to contain enough information to verify the pipe support design and to manufacture the device. As a minimum submit:
 - 1. Scaled details of the device with dimensions.
 - 2. A table of applied forces and/or moments.
 - 3. A complete bill of materials.
 - 4. An isometric showing the applied forces and moments.
 - 5. A unique identification number and revision level.
 - 6. Stamp of a Registered Professional Engineer experienced in pipe support design as specified in paragraph 1.06.D.
 - 7. Detailed connections to existing structure.
 - 8. Shop and field welds.
- C. Provide pipe supports designed in accordance with the design loads indicated for 30-inch and larger; 24-inch and smaller will also include the following loads:
 - 1. Gravity Force: This force includes the weight of pipe, pipe contents, valves, equipment, insulation, etc.

2. Thermal Expansion Force: This force is developed by the restraint of free end displacement of the piping.
 3. Hydrostatic Forces: This force is developed by internal pressure during operation of the piping system.
- D. Provide pipe supports that do not overload or overstress the piping, equipment, or structure that they are supporting or are attached to. Allowable pipe stress to be within ANSI B31.1 code allowables.
- E. Provide support, guide, and anchor flexible couplings and expansion joints in accordance with the coupling and joint manufacturer's specifications.
- F. For piping 30-inch and larger, the deviation of pipe support locations from contract drawings must meet with Engineer's approval.
- G. Where possible, provide pipe supports designed using manufacturer's standard catalog products.
1. Provide pipe supports with individual means of adjustment for alignment.
 2. Furnish pipe supports complete with appurtenances including locking and adjusting nuts.
 3. Hanger rods: subject to tension loads only.
 4. Where lateral or axial pipe movement occurs, provide hangers for the necessary swing without exceeding 4 degrees. Provide base pipe supports designed using pipe slides; the bearing surfaces shall have 0.06 coefficient of friction, or less.
 5. Provide concrete inserts capable of supporting the design loads.
 6. Provide metal framing systems to support piping 2 inches and smaller.
 7. Provide insulated pipe supported using rigid load bearing insulation with minimum 16 gage shields to fit between the insulation and the support. Shields to encompass minimum 1/3 of the pipe circumference and be minimum 12 inches in length.
 8. Provide load bearing insulation capable of supporting the load, as a minimum on the bottom 90 degrees of the pipe support. Adjust to avoid interference of steel structures.
 9. Provide miscellaneous and supplementary steel as needed.
 10. Do not support pipe from other pipe, conduits, metal stairs, or equipment.

11. Chain, strap, T-bar, perforated bar, and/or wire hangers are not acceptable.
 12. Contact between piping and dissimilar metals such as hangers, building structural work, or equipment subject to galvanic action is not acceptable.
- H. Provide thrust anchors to resist thrust due to changes in diameter or direction or dead ending of pipelines. Anchorage required wherever bending stresses exceed allowable for pipe. Wall pipes may be used as thrust anchors only if so designed.
- I. Pipe Wall Attachments:
1. Types 2, 5, 6, 7, 12, 26, 36, 37 shall not be used.
 2. For copper pipe - Type 9, 10, 11, may be used up to 2", on uninsulated pipe. Copper plated. For larger than 2" and for insulated pipe, Types 1, 3, 4, 24, 38, 40 may be used.
 3. For ductile iron pipe, Types 1, 3, 24, 38, 39, 40, 42 may be used.
 4. For steel and stainless steel, Types 1, 3, 24, 35, 38, 39, 40, 42, 43, 44, 45, and 46 may be used. For stainless steel, Type 24, 35 and 39 must be stainless T304 or 316. Other types in contact with pipe wall may be Type 304 or 316, or may be isolated from the pipe wall with minimum 22 ga stainless steel shim stock wrapped around the pipe and held in place with stainless steel draw bands.
- J. Structural Attachments:
1. Female threaded inserts shall not be used.
 2. Types 19, 20, 25, 27, 34 shall not be used.
 3. Forged Type 23 may be used. Cast or formed sheet metal Type 23 shall not be used.
 4. For all piping systems Types 18, 22, 28, 29, 30, 31, 32, 33 are acceptable.
 5. Plate bolted and grouted to concrete with stud anchors similar to Hilti "Qwik Bolt" or "HVA" are acceptable.
 6. Devices embedded in concrete such as Type 18 and patent systems (Unistrut or equal) are acceptable, when utilized in accordance with manufacturers recommendations and approved by Engineer.
- K. Use concrete piers to support pipe as indicated and specified, or as approved by Engineer.
- L. Support components shall be as required by MSS-SP-58.

2.04 FABRICATION:

- A. Provide pipe supports formed in accordance with paragraph 5.1 of MSS-SP 58.
- B. Provide welding in accordance with Structural Welding Code.
- C. Provide dimensional tolerances as specified in paragraph 2 of MSS-SP-89.
- D. Provide threading and tapping in accordance with paragraph 3.2.5 of MSS-SP-89.

2.05 SHOP PAINTING:

- A. No painting required as all pipe supports shall be constructed of Type 316 stainless steel or hot dipped galvanized steel (inside Aeration Building).

PART 3 - EXECUTION

3.01 GENERAL:

- A. Perform welding in accordance with Structural Welding Code: Except that welding pipe wall attachments to pipe shall be governed by ANSI/ASME B31.1.
 - 1. Visually inspect welding while the operators are making the welds and again after the work is completed. After the welding is completed, hand or power wire brush welds, and clean them before the Engineer makes the check inspection. The Engineer shall inspect welds with magnifiers under light for surface cracking, porosity, and slag inclusions; excessive roughness; unfilled craters; gas pockets; undercuts; overlaps; size; and insufficient throat and concavity. The Engineer shall inspect the preparation of groove welds for throat opening for snug positioning for back-up bars.
 - 2. Nondestructive evaluation of welds connecting structural steel members subjected to critical stresses: Perform in accordance with the weld quality and standards of acceptance in AWS D1.1.
 - 3. Magnetic Particle Inspection: Perform in accordance with ASTM E 709.
 - 4. Liquid Penetrant Inspection: Perform in accordance with ASTM E 165.
 - 5. Weld areas containing defects exceeding the standards of acceptance in accordance with AWS D1.1, Section 3.7. Provide additional testing of the repaired area at no additional cost to the Owner, as required by Engineer.
 - 6. Test locations: As selected by the Engineer.

- B. Proceed with installation of pipe supports only after required building structural work has been completed and concrete support structure has reached its 28-day compressive strength as specified in Section 03300.
- C. Install pipe supports; comply with MSS SP-69. Group parallel runs of horizontal piping to be supported together on trapeze type hangers.
- D. Install pipe supports to provide indicated pipe slopes. Do not exceed maximum pipe deflections allowed by ANSI B31.1.
- E. For exposed continuous pipe runs, install pipe supports of same type and style as installed for adjacent similar piping.
- F. Install pipe supports to allow controlled movement of piping systems. Permit freedom of movement between pipe anchors and facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- G. Piping to be free to move when it expands or contracts except where fixed anchors are indicated. Where hanger rod swing length cannot be provided or where pipe movement based on expansion of 1 inch per 100 feet for each 100 degree F change in temperature exceed 1/2 inch, provide sliding supports.
- H. Prevent contact between dissimilar metals. Where concrete or metal pipe support is used, place 1/8 inch thick teflon, neoprene rubber, or plastic strip under piping at point of bearing. Cut to fit entire area of contact between pipe and pipe support.
- I. Prevent electrolysis in support of copper tubing by use of pipe supports which are copper plated or plastic coated. Electrician's tape is not an acceptable isolation method.
- J. Apply an antiseize compound to nuts and bolts on all pipe supports.
- K. Locate reinforcing steel with x-ray in concrete support structure prior to drilling.

3.02 INSTALLATION OF BUILDING ATTACHMENTS:

- A. Support piping from structural framing, unless otherwise indicated.
- B. Concrete Inserts:
 - 1. Locate inserts so that total load on insert does not exceed manufacturer's recommended maximum load.
 - 2. Use expansion anchors to anchor support to hardened concrete or completed masonry.

3.03 THRUST ANCHORS AND GUIDES:

A. Thrust Anchors:

1. Center thrust anchors between expansion joints and between elbows and expansion joints for suspended piping. Anchors must hold pipe rigid to force expansion and contraction movement to take place at expansion joints and/or elbows and to preclude separation of joints.
2. Restraining rod size and number shall be as indicated.

B. Pipe guides: provided adjacent to sliding expansion joints in accordance with recommendations of National Association of Expansion Joint Manufacturers.

3.04 PIPE SUPPORT:

- A. Where piping of various sizes is to be supported together, space supports for largest pipe size and install intermediate supports for smaller diameter pipe.
- B. Provide minimum of 2 pipe supports for each pipe run unless approved by the Engineer.
- C. Where piping connects to equipment, support by a pipe support and not by equipment.
- D. Arrange pipe supports so that there is no interference with maintenance or removal of equipment.
- E. Unless otherwise indicated or authorized by Engineer, place piping running parallel to walls approximately 1-1/2 inches out from face of wall and at least 3 inches below the ceiling.
- F. Pedestal pipe supports: adjustable with stanchion, saddle, and anchoring flange. Provide grout between baseplates and floor.
- G. Piping supports for vertical piping passing through floor sleeves: hot dipped galvanized steel riser clamps.
- H. Support piping to prevent strain on valve, fitting, or equipment. Provide pipe supports at changes in direction or elevation, adjacent to flexible couplings, adjacent to nonrigid joints, and where otherwise indicated. Do not install pipe supports in equipment access areas or bridge crane runs.
- I. Stacked horizontal runs of piping along walls may be supported by a metal framing system attached to concrete insert channels.
- J. Do not support piping from other piping.

3.05 GALLERY AND TUNNEL PIPING:

- A. Support piping by a metal framing system. Extend framing across gallery or tunnel and down both walls or columns to floor.
- B. Maintain 3 feet clear around all equipment and devices in all trades.

3.06 INSULATED PIPING:

- A. Attach clamps, including spacers, to piping with clamps projecting through insulation; do not exceed allowable pipe stresses.
- B. Where low compressive strength insulation or vapor barriers are indicated on cold or chilled water piping, install coated protective shields. For pipe 8 inch and over, install wood insulation saddles.
- C. Where insulation without vapor barrier is indicated, install protection saddles on piping 2 inch and larger.

END OF SECTION

SECTION 15101

VALVES, HYDRANTS, AND APPURTENANCES

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. Provide valves, hydrants, and miscellaneous piping appurtenances as indicated and specified.

1.02 RELATED WORK:

- A. Division 1: General Requirements
- B. Section 02210: Earth Excavation, Backfill, Fill, and Grading

1.03 REFERENCES:

- C. American Society for Testing and Materials (ASTM):
 1. ASTM A48: Specification for Gray Iron Castings.
 2. ASTM A126: Standard Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
 3. ASTM A536: Specification for Ductile-Iron Castings.
 4. ASTM B61: Standard Specification for Steam or Valve Bronze Castings.
 5. ASTM B62: Standard Specification for Composition Bronze or Ounce Metal Castings.
 6. ASTM B98: Standard Specification for Copper-Silicon Alloy Rod, Bar, and Shapes.
 7. ASTM B271: Standard Specification for Copper-Base Alloy Centrifugal Castings.
 8. ASTM B584: Standard Specification for Copper Alloy Sand Castings for General Applications.
- D. American National Standards Institute (ANSI):
 1. ANSI B2.4: Hose Coupling Screw Threads.

2. ANSI B16.1: Cast-Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, 800.
3. ANSI B16.4: Cast-Iron Threaded Fittings, Class 125 and 250.
4. ANSI B16.10: Face-to-Face and End-to-End Dimensions of Ferrous Valves.

E. American Water Works Association (AWWA):

1. AWWA C500: Standard for Gate Valves, 3 in. through 48 in. NPS, for Water and Sewage System.
2. AWWA C502: Standard for Dry-Barrel Fire Hydrants.
3. AWWA C503: Standard for Wet-Barrel Fire Hydrants.
4. AWWA C507: Standard for Ball Valves, Shaft- or Trunnion - Mounted - 6 in. through 48 in. - for water pressures up to 300 psi.
5. AWWA C508: Standard for Swing Check Valves for Waterworks Service, 2 in. through 24 in.
6. AWWA C509: Standard Specifications for Resilient-Seated Gate Valves, 3 in. through 12-in. NPS, for Water and Sewage Systems.

F. Steel Structures Painting Council (SSPC):

1. SP10: Surface Preparation Specifications, No. 10 Near White Blast Cleaning.

G. Aluminum Association (AA):

1. Aluminum Alloy and Temper Designation.

1.04 SUBMITTALS:

A. Shop Drawings: Submit the following in accordance with Section 01300 - SUBMITTALS:

1. Submit manufacturer's specifications, catalog data, descriptive matter, illustrations, certified shop drawings, wiring, diagrams, etc.
2. Operating and maintenance instructions and parts lists.

1.05 QUALITY ASSURANCE:

- A. Suitable-type enclosures for specified atmospheres.

- B. Single manufacturer for a valve type.
- C. Contractor responsible for verifying outside diameter of pipe to be tapped.
- D. Painting:
 - 1. Shop coats compatible with and made by same manufacturer as field applied coats. All coating surface preparation and coating use, mixing, application, and curing in accordance with current printed instructions of coating manufacturer.
 - 2. Coatings in contact with potable water, in any part of municipal water system, suitable for use with potable water, approved for such use by USFDA or other appropriate authorities and not to impart harmful chemicals, taste, or odor to water.
- E. Brass or lamicoid valve identification tags, minimum 1 square inch stamped or engraved.

1.06 DELIVERY, STORAGE AND HANDLING:

- A. Provide in accordance with Section 01610.

PART 2 - PRODUCTS

2.01 GATE VALVES - 4-INCH AND LARGER:

- A. General:
 - 1. Non-potable water service: Use solid wedge, resilient seat gate valves.
 - 2. Metallic seated valves: Conform to AWWA C500 except as herein modified.
 - 3. Resilient seated valves: Conform to AWWA C509 except as herein modified.
 - 4. Use bronze grades A, D, or E of AWWA C500 or C509 for wetted bronze parts.
 - 5. Working water pressure: Minimum:

Valve Size	Pressure
4 to 12-in.	175 psi
14-in. and larger	150 psi
14 to 24-in.	150 psi
30-in. and larger	120 psi

6. Exposed valves: Flanged OS&Y valves. Face-to-face dimensions to comply with ANSI B16.10 and flanges with ANSI B16.1.
7. Buried valves: Mechanical joint ends, non-rising stem valves with operating nut in lieu of hand wheel. Provide gate boxes, steel extension stems or universal-joint operating rods with 2-in. square operating nuts at upper end with coupling connected to valve stem to bring operating nut to within 3 feet of ground surface.
8. Provide counterclockwise rotation to open valves (on non-potable water).
9. Provide handwheels with arrow and word "open" to indicate open direction.
10. Provide geared operators for all valves 8-inch and larger. Gearing shall be steel with enclosed cases. Provide bevel gears where required by position of valve. Provide buried valves with totally enclosed gear cases to enclose both the gears and valve stuffing box and provide gasketed stainless steel removable cover plates with stainless steel fasteners to allow access to the stuffing box.
11. Provide conventional packing in OS&Y valves.
12. Provide conventional packing or double O-rings in non-rising stem valves.
13. Valves capable of being repacked or O-ring replaceable while under pressure.
14. Provide corrosion resistant steel bolts and bronze nuts for stuffing box follower.

B. Solid Wedge Gate Valves:

1. Manufacturers: Apollo Valves; Crane Co.; M&H; Walworth Co; Stockham Valves and Fittings Co.; or acceptable equivalent product.

C. Resilient Seat Gate Valves:

1. Manufacturers: Clow Corp.; M&H; Kennedy Div.; American-Darling Valve Div.; or acceptable equivalent product.
2. Provide resilient seats of materials that are resistant to liquid in valve.

2.02 SWING CHECK VALVES:

A. Valves 3-in. and larger:

1. Manufacturers: Val-Matic Valve & Mfg. Co. (Series 7200); APCO Valves (CRF Style 100); Pratt Valve (RD Series); or acceptable equivalent product.

2. Valve design and manufacture shall conform to AWWA C508, except as herein modified.
3. The check valves shall be suitable for installation and operation in vertical piping.
4. Ductile iron body and access cover, ASTM A536 Grade 65-45-12. Cover bolts shall be Type 316 stainless steel.
5. Rubber disc shall be reinforced BUNA-N rubber.
6. Flanged ends faced and drilled to ANSI B16.1 Class 125.

7. Working water pressure as follows:

<u>Size</u>	<u>Pressure</u>
3 to 12 inches	175 psi
14-in. and larger	150 psi

8. Interior and exterior surfaces shall be coated with manufacturer's standard epoxy coating system.
9. Design shall provide full port opening and a short disc stroke to minimize travel to close.
10. Design to provide a low headloss.
11. Valve will be submerged in a tank and shall have no external features or adjustments.

2.03 NON-LUBRICATED ECCENTRIC PLUG VALVES:

- A. Manufacturers: Val-Matic Valve & Mfg. Co.; DeZurik, Inc.; or acceptable equivalent product.
- B. Non-lubricated, eccentric type with resilient seats are required for all sludge process services including RAS and WAS.
- C. Bodies of cast iron, ASTM A126 Class B with bolted bonnets. Suitable for 175 psi working pressure for valves 12-in. and smaller and 150 psi for valves 19-inch. and larger.
- D. Port areas of valves 20-in. and smaller not less than 80 percent of pipe area. Port areas of valves 24-in. and larger not less than 70 percent of pipe area.
- E. Valve seats of Neoprene or Buna-N synthetic rubber. Seat material shall coat the plug or shall be held by a stainless steel seat ring and shall be held attached to the valve with self-locking stainless steel screws.

- F. Provide valves with coated plugs with mating seats of 90 percent, minimum, pure nickel welded into the body of valves 3-in. and larger.
- G. Provide valves with seats clamped to valve with mating seat of 90 percent, minimum, pure nickel welded to the valve, or coat the valve body with thermally bonded nylon and coat the valve plug and bonnet with thermally bonded epoxy.
- H. Upper and lower plug journal bearings either thermally bonded epoxy coatings, or removable, permanently lubricated stainless steel bushings for valves 20-in. and smaller; and bronze bearings with stainless steel bushings for valves 24-in. and larger.
- I. Stem seals of either adjustable multiple V-packing or multiple point contact rubber rings. Stem seals replaceable without valve disassembly.
- J. Flanged ends faced and drilled 125-lb. AN Standard for exposed valves 3-inches and larger; screwed ends on smaller valves. Mechanical joint ends for buried valves.
- K. Valves 6-inches and under: wrench operated except as specified or indicated. Valves 8-inches and larger: gear operated with handwheels. Gear operators: totally enclosed worm gear or traveling nut type, permanent lubrication, watertight and dustproof, with adjustable open and closed stops and plug position indicator.
- L. Buried or submerged valves: Provide gear operator with extension stem, operating nut, and valve box with stem protection. Gear operator to be totally enclosed with gasketed stainless steel covers with stainless steel fasteners for access to valve packing.
- M. Provide one wrench for each four wrench-operated valves. Provide gear operator for valves where lack of space prevents wrench operation. Provide wrench of sufficient length for easy operation at rated working pressure.

2.04 BALL VALVES:

- A. Manufacturers: Apollo Valves; Henry Pratt Co.; or acceptable equivalent product.
- B. Provisions:
 - 1. Rubber-seated ball valves, shaft or trunnion-mounted, used in lieu of cone valves of hydraulically operated plug type, complete with hydraulic cylinder, control devices, piping, and all necessary appurtenances. All ball valves product of one manufacturer.
 - 2. Conditions of service, valve controls, materials, workmanship, and testing as specified.
 - 3. Conform to AWWA C507 except as herein modified.

4. Body: Cast iron or ductile iron, flanged ANSI B16.1 with support legs or pads; Class 150.
5. Plug: Cast iron or ductile iron, with full unobstructed circular port diameter.
6. Seats: Single or double seated, mounted on body plug, resilient seat to be Buna-N or other synthetic elastomer resistant to oil and grease. Wearing surfaces to be 316 stainless steel. Droptight shutoff in both directions.
7. Bearings: Bronze sleeve type, zinc free, permanently lubricated. Provide two-way thrust bearing.
8. Shafts: Stainless steel, chrome moly steel or monel, keyed or pin connected to plug.
9. Seals: O-ring bearing seals and O-ring or split-V-type packing shaft seal.
10. Cast in raised letters on body, size of opening, name of maker, year of manufacturer, and working pressure for which designed.

2.05 HOSE GATES:

- A. Manufacturers: Walworth Co.; Jenkins Bros.; or acceptable equivalent product.
- B. For 1-1/4-in hose: Assembly of 1-1/4-in. bronze gate valve, bronze pipe nipple and male cam and groove coupling as specified in Section 15370.
- C. For 3/4-in. hose: 175-lb. minimum WOG, ASTM B62 bronze, solid wedge nonrising-stem gate or angle valve, female standard pipe thread on inlet and male hose thread on outlet, bronze cap and brass chain. Threads ANSI B2.4.

2.06 TAPPING SLEEVES AND VALVES:

- A. Manufacturers: Mueller Co.; M&H Valve & Fittings; Clow Corporation; or acceptable equivalent product.
- B. Tapping sleeves and valves consist of split cast-iron sleeve tee with mechanical joint ends on main, flange on branch, and tapping type gate valve with one flange end and one mechanical joint end. Valve conforming to requirements for gate valves specified in this Section and furnished with 2-in. square operating nut.

2.07 CURB STOPS:

- A. Manufacturers: Mueller Co. (Oriseal type); Ford Meter Box Co. (Ball-valve type); Hayes Mfg. Co. (Type 4008-CF); or acceptable equivalent product.

B. Minneapolis pattern, bronze stops with threaded ends, bronze stem and key, bronze ball or plug, O-ring port and stem seals.

C. Combined cap and tee handle to accommodate threaded service box.

2.08 CORPORATION STOPS:

A. Manufacturers: Clow Corporation; Mueller Co.; or acceptable equivalent product.

B. Materials: Bronze with a lapped, ground key. Inlet thread of steep taper type. Outlet connections to suit type of pipe or tubing connected.

2.09 YARD HYDRANTS:

A. Manufacturers: Kupferle Foundry Co. Mainguard #80WD; or acceptable equivalent product.

B. Provide freeze proof cast brass hydrant with brass casing, removable brass operating parts, neoprene plunger, aluminum shield, 2 inch threaded hose connection, and wheel operator. Provide hydrant for 6-foot depth of bury.

C. A 4-inch gate valve shall be provided and installed on the existing plant water main, after removal of the existing fire hydrant that will be replaced by a yard hydrant. The 4-inch buried isolation valve shall be provided with a valve box and operator wrench.

D. Provide pipe and fittings to transition from the 4-inch isolation gate valve to the 2" threaded female connection on the yard hydrant. The transition shall include a di-electric fitting to avoid corrosion due to the dissimilar metals.

E. Where space is not available to cut the 4" piping back far enough for a straight run to the yard hydrant including the 4" valve, reducer, di-electric fitting, and other necessary components, add elbows in the 2" piping to offset the yard hydrant.

2.10 VALVE BOXES:

A. Manufacturers: Clow Corporation; Mueller Co.; or acceptable equivalent product.

B. Materials:

1. Valve boxes adjustable, telescoping, heavy-pattern type of cast iron. Designed and constructed to prevent direct transmission of traffic loads to pipe or valve. Adjustable through at least 6 in. vertically without reduction of lap between sections to less than 4 in. Inside diameter at least 4-1/2 in. Lengths as necessary for depths of valves or stops with which boxes are used. Top of cover flush with

top of box rim. Cast arrow and word OPEN to indicate direction of turning to open valve in top of valve covers.

2. Curb boxes for curb stops, cast iron extension type, Minneapolis pattern base, diameter to suit curb stop size; flush cover marked WATER.

2.11 FLOOR BOXES

- A. Manufacturers: Clow Corporation; Mueller Co.; Coldwell-Wilcox Co.; or acceptable equivalent product.
- B. Cast iron with bronze bushing, sized to accommodate extension stem and suitable for installation in concrete floor. Provide bronze cover with recesses cast or drilled for inserting spanner-type wrench for removal of cover. Suitable wrench for removal of cover furnished with box.

2.12 T-HANDLE OPERATING WRENCHES:

- A. Furnished by gate or valve manufacturer.
- B. T-handle operating wrenches provided in lengths necessary to permit operation of all valves by operators of average height working in normal positions.
- C. Provide one wrench for every four (4) wrench operated valves.

2.13 PAINTING:

- A. For ferrous surfaces not submerged (TWO SHOP COATS) of Pug Primer made by Koppers Co., Inc.; Carboline admiral AD-1567 Primer made by Carboline Company; Tnemec 77 Chem-Prime made by Tnemec Co.; Chromox 13R50 Primer made by Mobil Chemical Co.; or acceptable equivalent product.
- B. For ferrous surfaces submerged (ONE SHOP COAT) Koppers 654 Primer made by Koppers Co., Inc.; Carboline 193 Primer made by Carboline Co., Inc.; or acceptable equivalent product.
- C. Application:
 1. Paint equipment and appurtenance in shop before exposure to weather and after thorough cleaning to remove all rust, dirt, grease, and other foreign matter.
 2. Blast clean submerged ferrous surfaces, including full height of sluice gates, to near-white metal in accordance with SSPC-SP10, immediately before painting.
 3. Paint surfaces in shop upon cleaning as follows:

- a. Shop finish with asphalt varnish all interior surfaces of all hydrants, iron body gate valves, exterior surfaces of buried or submerged valves and gates, and miscellaneous piping appurtenances.
 - b. Shop prime submerged ferrous surfaces immediately after blast-cleaning to near-white metal, with one coat of polyamide epoxy having not less than 43 percent solids content by volume, applied to a min. of 3 mils dry film thickness.
 - c. Shop prime non-submerged ferrous surfaces with two coats of primer.
4. Shop coat ferrous surfaces, not painted, with grease or other protective coating.

PART 3--EXECUTION

3.01 GENERAL:

- A. Prior to installation, protect stored valves and appurtenances from damage due to exposure to sunlight, heat, dirt, debris, freezing and thawing, vandalism, etc.
- B. Clean all debris, dirt, gravel, etc, from inside of piping before placing valves in place.
- C. Erect and support valves in respective positions free from distortion and strain on appurtenances during handling and installation. Inspect material for defects in workmanship and material. Clean out debris and foreign material from valve openings and seats, test operating mechanisms to check proper functioning, and check nuts and bolts for tightness. Repair, valves and other equipment which do not operate easily or are otherwise defective.
- D. Set plumb and support valves adequately in conformance with instructions of manufacturer. Shim valves mounted on face of concrete vertically and grout in place. Install valves in control piping for easy access.
- E. Provide sleeve type coupling or flexible type grooved coupling on downstream side of buried valves to assist in valve removal.
- F. Provide valves with extension stems where required for convenience of operation. Provide extension stems for valves installed underground and elsewhere so that operating wrench does not exceed 6 ft. in length.

3.02 GATE VALVES:

- A. Install gate valve stem as indicated or with stems between horizontal and vertical up. Valves installed with stems below horizontal not allowed.

3.03 CHECK VALVES:

- A. Install swing check valves as indicated, in pipeline carrying sewage or sludge.

3.04 PLUG VALVES:

- A. Install valves in horizontal sewage and sludge piping with shaft horizontal such that in open position, plug located in upper part of valve body. Valves oriented so that in closed position, plug is at downstream end of valve.

3.05 YARD HYDRANTS:

- A. Set plumb, and center buried valve and valve box. Tamp earth fill carefully around valve box to a distance of 4 ft. on all insides of box, or to undisturbed trench face, if less than 4 ft. At least same depth of cover on hydrant and connecting pipe as distribution main. Set hydrant upon slab of stone or concrete not less than 4 in. thick and 14 in. square. Firmly wedge side of hydrant opposite pipe connections against vertical face of trench with concrete thrust block. Not less than 7 cu. ft. of stone placed around base of hydrant at location of drain holes. Backfill around hydrants as specified under Section 02210. Clean hydrant and valve interiors of all foreign matter before installation and inspect in opened and closed positions.

3.06 VALVE BOXES:

- A. Provide valve box for each buried stop and valve.
- B. Set box so top is flush with finished surface and so box does not bear on valve, stop, or pipe.

3.07 PAINTING:

- A. Touch-up abraded areas of shop coat with paint of same type as shop coat, even to extent of applying entire coat if necessary, and clean deteriorated surfaces, before applying touch-up coat.
- B. Apply painting when temperature not less than 40 deg. F. and humidity not greater than 85 percent (85%) or if rain has not been forecast, unless otherwise permitted by Engineer.

END OF SECTION

SECTION 15370

MISCELLANEOUS PROCESS PIPING AND APPURTENANCES

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. Provide and test all miscellaneous pipe, fittings, and appurtenances as indicated and specified.

1.02 RELATED WORK:

- A. Division 1: General Requirements
- B. Section 02210: Earth Excavation, Backfill, Fill, and Grading
- C. Section 02615: Ductile-Iron Pipe and Fittings

1.03 REFERENCES:

- A. American Welding Society: AWS B3.0
- B. Manufacturer's Standardization Society: MSS SP-69
 1. ASTM A47: Standard Specification for Malleable Iron Castings
- C. American Society for Testing and Materials:
 1. ASTM A53: Standard Specification for Pipe, Steel, Black, and Hot-Dipped, Zinc-Coated Welded and Seamless
 2. ASTM A105: Standard Specification for Forgings, Carbon Steel, for Piping Components
 3. ASTM A120: Standard Specification for Pipe, Steel, Black, and Hot-Dipped, Zinc-Coated (Galvanized) Welded and Seamless, for Ordinary Uses
 4. ASTM 181: Standard Specification for Forgings, Carbon Steel, for General Purpose Piping
 5. ASTM 197: Standard Specification for Cupola Malleable Iron
 6. ASTM A307: Standard Specification for Carbon Steel Externally Threaded Standard Fasteners

7. ASTM B43: Standard Specification for Seamless Red Brass Pipe, Standard Sizes
8. ASTM B62: Standard Specification for Composition Bronze or Ounce Metal Castings
9. ASTM B75: Standard Specification for Seamless Copper Tube
10. ASTM B88: Standard Specification for Seamless Copper Water Tube
11. ASTM D1330: Standard Specification for Rubber-Sheet Gaskets

D. American National Standards Institute:

1. ANSI B16.1: AN Standard for Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 800
2. ANSI B16.3: AN Standard for Malleable Iron Threaded Fittings, Class 150 & 300
3. ANSI B16.9: AN Standard for Factory-Made Wrought Steel Buttwelding Fittings
4. ANSI B16.15: AN Standard for Cast Bronze Threaded Fittings, 125 and 250 lb
5. ANSI B16.18: AN Standard for Cast Copper Alloy Solder-Joint Pressure Fittings
6. ANSI B16.22: AN Standard for Wrought Copper and Bronze Solder-Joint Pressure Fittings
7. ANSI B16.26: AN Standard for Cast Copper Alloy Fittings for Flare Copper Tube

1.04 SUBMITTALS:

- A. Shop Drawings: Submit the following in accordance with Section 01300-
SUBMITTALS:

1. Submit manufacturer's published material information, to verify conformance with these specifications.
2. Submit certified copies of test reports.

1.05 QUALITY ASSURANCE:

- A. Provide manufacturer's certification that materials meet or exceed minimum requirements as specified.

- B. Reject materials contaminated with gasoline, lubricating oil, liquid or gaseous fuel, aromatic compounds, paint solvent, paint thinner, and acid solder.
- C. Pipe-joint compound, for pipe carrying flammable or toxic gas, must bear approval of Underwriters' Laboratories or Factory Mutual Engineering Division.

1.06 DELIVERY, STORAGE AND HANDLING:

- A. Provide in accordance with Section 01610.
- B. Receiving:
 - 1. Inspect and inventory items upon delivery to site.
 - 2. Store and safeguard material in acceptable place and manner.

PART 2 - PRODUCTS

2.01 MATERIAL:

- A. 250 WSP Unions: Brass or bronze unions for joining nonferrous pipe, malleable brass or bronze-seated iron or steel unions for joining ferrous pipe, PVC unions for joining PVC pipe.
- B. Solid String or Wire Solder: 95 percent tin and 5 percent antimony, inside piping; and silphos solder, underground piping.
- C. Flanged Joints: Bolt and nuts, Grade B, ASTM A307-78; bolt number and size same as flange standard; studs - same quality as machine bolts; 1/16-in. thick rubber gaskets with cloth insertions; rust-resistant coatings.
- D. Sleeve Type Couplings or Fittings: 3/4-in. tierods, 3/4-in. bridles, pipe clamps.
- E. Temporary Plugs: Plugs or caps; watertight plugs for exterior buried piping.
- F. Sleeve-Type Couplings: Style 38 couplings, manufactured by Dresser Mfg. Div., Bradford, PA; Style 411 couplings, manufactured by Rockwell International, Municipal & Utility Div., Pittsburgh, PA; Series 200 coupling manufactured by R.H. Baker & Co., Inc., Los Angeles, CA; coupling with galvanized steel bolts, nuts, and liquid exposure type gaskets or acceptable equivalent product.
- G. Wall Sleeve Seals: Compression type units with molded rubber links and bolt holes, elongated backup washers, and Type 316 stainless steel nuts and bolts.

2.02 COPPER TUBING:

A. Materials:

1. Type L copper tubing in building, drawn-temper with cast-bronze or wrought-copper, soldered joint fittings. Type K buried tubing drawn temper for sizes larger than 1 in.; tubing 1 in. and smaller Type K annealed temper. ASTM B88.

B. Joints: Soldered

C. Fittings: Cast-bronze

1. Cast Bronze Solder - Joint Pressure Fittings: ANSI B16.18

2.03 SLEEVE TYPE COUPLINGS:

- A. Manufacturer: Style 38 couplings made by the Dresser Mfg. Div., Bradford, PA; Rockwell Style 411 couplings made by Rockwell International, Municipal & Utility Div., Pittsburgh, PA; Baker Series 200 made by R.H. Baker & Co., Inc., Los Angeles, CA; or acceptable equivalent product.
- B. Provisions: Couplings provided with stainless steel bolts and nuts (galvanized when stainless not available) and gaskets of composition suitable for exposure to wastewater.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Ensure interior lines parallel to building walls wherever possible. Install piping to accurate lines and grades, and support by acceptable hangers spaced as necessary, but not more than 8 ft. apart. Where temporary supports are used, ensure rigidity to prevent shifting or distortion of pipe. Provide for expansion where necessary.
- B. Support piping laid in trenches in trench on bed of selected backfill material which maintains desired line and grade.
- C. Pitch all piping toward low points. Provide for draining low points.
- D. Before assembly, remove all dirt and chips from inside pipe and fittings and from threads.
- E. After cutting to final lengths, ream ends of pipe to remove burrs.
- F. Clean-cut threads of all long tapered screwed joint. Make up screwed joints with acceptable pipe-joint compound applied to male threads only.

- G. Disjoint entirely, joints which are required to be backed off. Wipe clean, threads of both pipe and fittings. Apply new joint compound. Reassemble connection.
- H. Prepare solder joints for copper tubing by cleaning ends of tubing and inner surfaces of fittings with steel wool until bright. Give cleaned surfaces thin coating of acceptable soldering flux, and insert tubing end into fitting as far as possible. Heating and finishing of joint done in accordance with recommendations of manufacturer of the fittings, using solid string or wire solder composed of 50 percent (50%) tin and 50 percent (50%) lead inside, and 95 percent tin and 5 percent (5%) antimony underground. Use of cored solder not permitted.
- I. Cut and burr flared joints for copper tubing. Slip sleeve nut on tubing and flare end with flaring tool. Take care not to crack or split flared portion. If inspection reveals damage, cut flare off and make new flare. Seat flared end squarely on fitting and tightened nut.
- J. Use dielectric bushings or unions when ferrous pipes join nonferrous pipes carrying liquid, either underground or elsewhere.
- K. Use sufficient number of unions for dismantling of all water pipe, valves, and equipment. 250 WSP Unions made of brass or bronze for joining nonferrous pipe and malleable iron or steel with brass or bronze seats for joining ferrous pipe.
- L. Welding in accordance with AN Standard B31 and AWS B3.0.
- M. Install welding fittings on all welded lines. Make changes in direction and intersection of lines with welding fittings. Do not miter pipes to form elbows or notching of straight runs to form tees, or any similar construction. Do not employ welder who has not been fully qualified in above specified procedure and so certified by approved welding bureau or similar locally recognized testing authority.
- N. Make flanged joints with bolts; bolt studs with nut on each end, or studs with nuts where one flange is tapped. Number and size of bolts conforming to same AN Standard as flanges. Grade B bolts and nuts conforming to ASTM A307, unless otherwise indicated. Bolt studs and studs of same quality as machine bolts. Ring gaskets of rubber with cloth insertion, 1/16-in. thick gaskets. Before flanged pieces are assembled, remove rust-resistant coatings from machined surfaces, clean gaskets and smooth all burrs and other defects. Make up flanged joints tight, care being taken to prevent undue strain upon valves or other pieces of equipment.
- O. Install tierods, pipe clamps, or bridles when sleeve type couplings or fittings are used in piping system, where indicated and at changes in direction or other places as necessary, to prevent joints from pulling apart under pressure. Bridles and tierods at least 3/4-inch in diameter, except where tierods replace flange bolts of smaller size, in which case fit with nut on each side of pair of flanges.

3.02 INSTALLATION OF COPPER PIPING:

A. Inspection:

1. Examine areas to receive piping for:
 - a. Defects that adversely affect execution and quality of work.
 - b. Deviations beyond allowable tolerances for piping clearances.
2. Start work only when conditions are satisfactory.

B. Piping Layout:

1. Complete installation to present neat orderly appearance.
2. Do not block openings or passageways with piping.
3. Run piping parallel to walls of building.
4. Keep piping free from contact with structure or installed items.
5. Allow clearances for expansion and contraction of pipe.
6. Anchor horizontal runs over 50 feet at midpoint to force expansion equally toward ends.

C. Workmanship:

1. Examine pipe and fittings before installation to assure no defective materials are incorporated.
2. Keep inside of pipe and fittings free of dirt and debris.

D. Placement:

1. Vertical Piping:
 - a. Secure at sufficiently close intervals to keep pipe in alignment and to support weight of pipe and contents.
 - b. Install supports at each floor or vertically at intervals of not more than 10 feet.

- c. If piping is to stand free of support, or if no structural element is available for support during construction, secure in position with wooden stakes or braces fastened to pipe.
2. Horizontal piping, suspended:
 - a. Support at sufficiently close intervals to maintain alignment and prevent sagging.
 - b. Support 1-1/4-inch or smaller pipe at 6-foot intervals.
 - c. Support 1-1/2-inch or larger pipe at 10-foot intervals.
 - d. Install hangers at ends of runs or branches and at each change of direction or alignment.
3. Horizontal piping, underground:
 - a. Lay piping on firm bed for entire length of trench except where supports are otherwise provided.
 - b. Employ partial backfilling and cradling to hold pipe in secure position during backfilling operations.
 - c. Backfill evenly on both sides of pipe to maintain alignment.
 - d. Anchor piping laid on grade prior to embedment in concrete.
4. Bending pipe:
 - a. Bend pipe by any method and to any radius within manufacturer's recommendation.
 - b. Only bend surface free of cracks and buckles.
5. Solder joints:
 - a. Ream or file pipe to remove burrs.
 - b. Clean and polish contact surfaces of joint.
 - c. Apply flux to both male and female ends.
 - d. Insert end of tube into fittings full depth of socket.
 - e. Bring joint to soldering temperature, in as short a time as possible.

- f. Form continuous solder bead around entire circumference of joint.
6. Brazed joints:
- a. Ream or file pipe to remove burrs.
 - b. Clean and polish contact surfaces of joint.
 - c. Apply flux to both male and female ends.
 - d. Insert end of tube into fittings full depth of socket.
 - e. Bring joint to brazing temperature in as short a time as possible.
 - f. Form continuous bead of filler material around entire circumference of joint.
7. Flared joints:
- a. Ream or file pipe to remove burrs.
 - b. Slip fitting over tube end to be flared.
 - c. Expand end of tube using flaring tool.
 - d. Tighten joint fitting.

3.03 HANGERS AND SUPPORTS:

- A. Refer to Section 15056 Pipe Supports.
- B. Piping supported by connected equipment NOT PERMITTED. Hanger locations are not generally on drawings; support systems by contractor.

3.04 WALL SLEEVE SEALS:

- A. Expand rubber against pipe and sleeve by tightening bolts when assembled around pipe and inserted in wall.

3.05 TEMPORARY PLUGS:

- A. Close open ends of pipe with temporary plugs or caps when pipe installation is not in progress. Use watertight plugs for exterior, buried piping, and if water or debris is in trench when work is resumed, do not remove until adequate provision has been made to prevent any water or debris entering pipe even if it necessitates dewatering trench.

3.06 TESTING:

- A. After installation, test all pipelines for watertightness. Furnish suitable testing plugs or caps, pressure pumps, pipe connections, gages, other equipment, all labor, and all water.
- B. Disconnect all equipment and devices which may be damaged by test pressures.
- C. Do not cover joints in underground piping with backfill material until piping has successfully passed pressure test.
- D. Where feasible, test pressure at least 100 psi or 1-1/2 times normal operating pressure, whichever is greater, and maintained for at least 30 minutes.
- E. Repair faulty joints even to extent of disassembling and remaking joint, remove defective pipe and fittings, and replace in manner satisfactory to Engineer.

3.07 PAINTING:

- A. Paint exposed piping and supports as required and specified.

END OF SECTION

SECTION 16000

ELECTRICAL REQUIREMENTS

PART 1–GENERAL

1.01 DESCRIPTION:

- A. Work includes general requirements for electrical work associated with this project.

1.02 RELATED WORK:

- A. Division 1 – General Requirements.
- B. Section 11304 – Submersible Solids Handling Pumps And Appurtenances.
- C. Section 16480 – Variable Frequency Drives

1.03 REFERENCES:

- A. ANSI/NFPA 70–National Electrical Code.
- B. ANSI/IEEE C2–National Electrical Safety Code.

1.04 REGULATORY REQUIREMENTS

- A. The rules and regulations of the federal, state, and local authorities and utility companies in force at the time of execution of the Contract shall become a part of this specification.
- B. When requested, CONTRACTOR shall provide written calculations to demonstrate compliance with applicable codes and the Contract Documents. This shall include, but not be limited to, conduit and wire sizing, junction box fill and sizing, pull box fill and sizing, conductor de-rating, and voltage drop. CONTRACTOR shall indicate calculation method used as well as compliance with applicable code, drawing, and specification.

1.05 CONTRACT DOCUMENTS:

- A. The Drawings and Specifications are complementary and are to be used with each other to fully define the Work.
- B. The drawings are generally diagrammatic, showing approximate desired locations and arrangements. Not all boxes, panels, etc. are shown on the drawings. CONTRACTOR shall coordinate the Work so that interferences are avoided. Provide all materials, offsets in conduit, fittings, etc., necessary to properly install the work. All offsets, fittings, etc., shall be provided without additional expense to OWNER.

- C. In preparing a Bid, CONTRACTOR shall include the cost of all items and procedures necessary to satisfy the requirements of all applicable codes, ordinances, and authorities, whether or not these are specifically covered by the drawings and specifications. All cases of serious conflict or omission between the drawings, specifications, and codes shall be brought to ENGINEER's attention, as herein before specified. CONTRACTOR shall carry out work and complete construction as required by applicable codes and ordinances.
- D. Any equipment roughed in improperly and/or not positioned on implied centerlines or as dictated by good practice shall be repositioned at no cost to OWNER.
- E. Discuss equipment locations with ENGINEER as to desired location in the various areas. In no case should equipment locations be determined by scaling drawings. Relocate equipment and bear cost of redoing work of other trades' work necessitated by failure to comply with this requirement.
- F. Electrical devices and equipment, etc., may be relocated in the best interest of the final product. Where relocation is within 10 feet of location shown on the drawings, and when CONTRACTOR is informed of necessary relocation before work is begun on this portion of the job, the relocation shall be at CONTRACTOR's expense.

1.06 EQUIPMENT PROVIDED UNDER OTHER DIVISIONS:

- A. Included in this Contract are electrical connections to equipment provided under other Divisions. CONTRACTOR shall refer to final shop drawings for equipment being furnished under other Divisions, for exact location of electrical equipment, and the various connections required.

1.07 SYSTEM DESCRIPTION:

- A. Provide a complete electrical system for each pump as indicated on the drawings or specified herein including, but not limited to:
1. Feeders, branch wiring, and electrical distribution equipment.
 2. All control wiring.
 3. Access panels and access doors for access to equipment.
 4. Wiring between system components if equipment is not pre-wired.
 5. Support system design and supports for electrical raceways.
 6. Code-required disconnects.
- B. CONTRACTOR shall connect the following equipment consisting of components indicated on the drawings or specified herein, including, but not limited to:
1. Pumps
 2. Control panels
 3. VFDs.
- C. Provide miscellaneous items for a complete and functioning system as indicated on the drawings and specified herein.

- D. CONTRACTOR shall provide and install control wiring and components as indicated and specified; all wires shall be labeled at each end. The OWNER will complete terminations in the plant control system cabinet only, with the CONTRACTOR completing terminations to equipment, pump local panels, and CONTRACTOR supplied materials.

1.08 QUALITY ASSURANCE:

- A. All electrical components shall bear the UL label, FM label, or other agency labels as appropriate for the materials.

1.09 SUBMITTALS

- A. CONTRACTOR shall submit to ENGINEER for approval prior to beginning work, shop drawings on the equipment and all electrical materials proposed to be furnished and installed in the Work. See Section 01300–Submittals for requirements.
- B. CONTRACTOR shall submit record drawings detailing the completed Work.
- C. CONTRACTOR shall submit Operations & Maintenance manuals for the completed work.
- D. CONTRACTOR shall submit test reports for all electrical testing specified herein.

PART 2–PRODUCTS

2.01 STANDARD PRODUCTS

- A. All equipment and products shall be of new manufacture, free of defects, and standard products in accordance with the applicable specifications.
- B. All equipment shall be UL labeled and NEMA approved.
- C. Unless specified otherwise, major distribution equipment such as motor starters, VFDs, etc., shall each be by the same manufacturer.
- D. All equipment and wiring shall be selected and installed for conditions in which it will perform with appropriate NEMA rated enclosures (NEMA 1 or NEMA 12 in the Aeration Building and NEMA 4X all other locations).
- E. All panels and hardware used on this project shall be manufactured of Type 316 stainless steel, except where otherwise noted.

2.02 WIRING DEVICES

- A. Wiring devices shall be UL listed and labeled.
- B. Outdoor receptacles shall be manufactured by Crouse-Hinds or Appleton.

- C. Receptacles shall be GFCI, 125-volt, 20-amp.
- D. Receptacles shall be mounted in an exterior UL listed enclosure for wet locations and shall be rated NEMA 4X with gasket.

2.03 WIRE

- A. All current carrying elements including, but not limited to, wire, cable, bus bars, switches, fuse holders, windings, etc. shall be solid copper, tin-plated solid copper, or silver-plated copper, without exception.
- B. All wires and cables shall be UL listed and labeled.
- C. Wire shall be 600-volt class.
- D. Wire shall be stranded copper and in accordance with ASTM B3.
- E. Wire shall be type THWN or XHHW-2.
- F. Power conductors shall be as indicated, minimum of number 12 AWG.
- G. Control wires shall be as indicated, minimum of number 18 AWG.

2.04 CONDUIT

- A. All conduit and fittings associated with this project shall be PVC coated rigid steel, except as otherwise noted. All ends shall be protected from the elements.
- B. The installer of PVC coated rigid conduit shall be certified in the installation of such materials. The installer's certificate of training shall be submitted.
- C. All conduit and fittings inside the Aeration Building can be rigid galvanized steel or seal tight.
- D. Any penetrations required through existing concrete shall be cored the full depth.
- E. Where concrete is cored for installation of conduit, the void between core hole and conduit shall be fully sealed with non-shrink grout or with link seal having Type 316 stainless steel hardware.

2.05 WIREWAY

- A. All wireway and fittings in the Aeration Building shall be mild steel and painted gray, except as otherwise noted.
- B. Wireway shall include hinged sections for easy access to the cables for pulling. The sections above the new VFDs shall all be hinged.

- C. Standard fittings and closure plates shall be used.
- D. Any penetrations required through existing panels shall be cleanly cut, ground, and sealed to eliminate sharp exposed edges.
- E. Wireway shall be Hoffman nVent or equal.

PART 3-EXECUTION

3.01 CONTINUITY OF SERVICE

- A. CONTRACTOR shall provide and maintain continuous services (power, controls, alarms, etc.) during the entire construction period with no more than two pumps out of service at any time except for pre-arranged short duration outages necessary for tie-ins).
- B. CONTRACTOR shall assume that start-up activities will be performed at separate times for each of the pumps.
- C. All testing that can be performed in the dry shall be completed and then the off-line tank filled for return to service. The re-activated tank and pump shall be in service for at least 4 days before the next tank can be removed from service.
- D. No service shall be interrupted or changed without permission from OWNER. Written permission shall be obtained before any work is started.
- E. When interruption of service is required, all persons concerned shall be notified and a prearranged time agreed upon. Notice shall be a minimum of 72 hours prior to the interruption.

3.02 CLEANUP AND REMOVAL OF RUBBISH

- A. Equipment shall be thoroughly cleaned of all stains, paint spots, dirt, and dust. All temporary labels not used for instruction or operation shall be removed.

3.03 CONCRETE WORK

- A. All cast-in-place concrete for new electrical equipment bases shown on the drawings shall be provided by CONTRACTOR, except where specifically noted to be provided by others.
- B. Where shown on the drawings, new equipment shall be set on 3 1/2-inch minimum leveling slabs including MCCs, free-standing enclosures, switchgear, etc. Pads shall be 3 inches larger on each side than equipment being supported.
- C. Concrete shall comply with Section 03300 Cast-In-Place Concrete.
- D. Provide all anchor bolts, metal shapes, and templates to be cast in concrete or used to form concrete for support of electrical equipment.

3.04 PAINTING

- A. All painting of electrical equipment shall be done by CONTRACTOR unless equipment is specified to be furnished with factory-applied finish coats.
- B. All electrical equipment shall be provided with factory-applied finish, unless PVC coated, stainless steel, or otherwise specified.
- C. If the factory finish on any equipment furnished by CONTRACTOR is damaged in shipment or during construction, the equipment shall be refinished by CONTRACTOR.

3.05 CAULKING

- A. Caulk with a caulking sealant where indicated on the electrical drawings or hereinafter specified.
- B. Caulking sealant shall be silicone construction sealant as manufactured by General Electric or two-part polysulfide conforming to the requirements and bearing the seal of the Thiokol Chemical Corporation, or as otherwise approved by the OWNER.
- C. Caulking sealant shall contain no acid or ingredients that will stain stone, corrode metal, or have injurious effect on painting. It shall be colored to match adjacent surroundings.
- D. Caulking shall be performed by craftsman skilled at such work.

3.06 BUILDING ACCESS

- A. CONTRACTOR shall arrange for the necessary openings in the building, structure, or existing panels as necessary to allow for admittance of all apparatus.
- B. When the installation requires openings and access through existing construction and the openings are not provided, CONTRACTOR shall provide the necessary openings.

3.07 COORDINATION

- A. Provide wiring for all motors and all electrically powered or electrically controlled equipment.
- B. All starters, VFDs, disconnects, relays, wire, conduit, pushbuttons, pilot lights, and other devices for the power and control of motors or electrical equipment shall be provided by CONTRACTOR except as specifically noted elsewhere in these specifications or on the drawings.
- C. Where starters, VFDs, or other devices are provided by others, they shall be connected and wired by CONTRACTOR.

- D. CONTRACTOR's drawings and specifications shall show number and horsepower rating of all motors furnished, together with their actuating devices. Should any change in size, horsepower rating, or means of control be made to any motor or other electrical equipment after the Contract is awarded, any additional costs because of these changes shall be the responsibility of CONTRACTOR. The existing pump power supply and wiring are for 15 horsepower pumps.
- E. All motors shall be provided for starting in accordance with local utility requirements and shall be compatible with the existing equipment as specified herein or under the other sections of the specifications.
- F. CONTRACTOR shall provide all line voltage power and control wiring (100 volts and above), for operation, control, and supervision of all motorized equipment, including wiring between motor starters, VFDs, and control devices as specified herein and as shown on the drawings. Numerous existing wires are re-used in the work, as noted on the drawings.
- G. CONTRACTOR shall connect and wire all apparatus according to approved wiring diagrams furnished by the various trades.

3.08 EXCAVATION AND BACKFILL

- A. Backfill of exterior trenches shall be compacted granular fill, unless otherwise noted. Compaction shall meet the requirements of Section 02210 Earth Excavation, Backfill, Fill, and Grading.
- B. Existing below ground electrical is in concrete encased duct banks.
- C. Care shall be taken to ensure no disturbance of bearing soil under foundations.

3.09 EQUIPMENT ACCESS AND LOCATION

- A. CONTRACTOR shall coordinate work of this division with that of other divisions so that all systems, equipment, and other components of the building will be installed at the proper time, will fit the available space, and will allow proper service access to those items requiring maintenance. This means adequate access to all equipment not just that installed under this division. Any components for the electrical systems that are installed without regard to the above shall be removed and relocated as required to provide adequate access at CONTRACTOR's expense.
- B. Where various items of equipment and materials are specified and scheduled, the purpose is to define the general type and quality level, not to set forth the exact trim to fit the various types of ceiling, wall, or floor finishes. Provide materials that will fit properly the types of finishes actually installed.
- C. All equipment, junction and pull boxes, and accessories shall be installed to permit access to equipment for maintenance. Any relocation of conduits, equipment, or accessories to provide maintenance access shall be accomplished by CONTRACTOR at no additional cost. Conduit shall be installed generally as indicated and to avoid creation of tripping hazards.

- D. Electrical equipment, devices, instruments, hardware, etc., shall be installed with ample space allowed for removal, repair, calibration, or changes to the equipment. Ready accessibility to equipment and wiring shall be provided without moving other equipment that is to be installed or that is already in place.
- E. Locate electrical equipment to fit the details, panels, decorating, or finish of the space. ENGINEER shall reserve the right to make minor position changes of the equipment before the Work has been installed.

3.10 WORKMANSHIP

- A. Install work using procedures defined in NECA Standard of Installation.
- B. Locations of process equipment, as shown on the drawings, are approximate.
- C. Equipment and control devices required under these specifications shall be mounted in a code-approved manner.
- D. Locations of utilization equipment and control devices as shown on the drawings are within 10 feet of actual positions. Any mounting of this equipment within this 10-foot distance will be performed at no additional cost to OWNER.
- E. Unless otherwise noted, equipment shall be fastened to building structure or equipment framework and not placed on the floor.
- F. Where materials, equipment apparatus, or other products are specified by manufacturer, brand name, and type or catalog number, such designation is to establish standards of desired quality and style and shall be the basis of the Bid.
- G. Materials and equipment of the types for which there are Underwriters Laboratories (UL) listings shall be so labeled and shall be used by CONTRACTOR.

3.11 AREA CLASSIFICATION

- A. As noted.

3.12 MODIFICATIONS TO EXISTING CONSTRUCTION

- A. Alterations:
 1. Alter, extend, and reconnect conduits as necessary.
 2. Reconnect existing conduits that were reused, cut, or exposed because of construction as quickly as possible.
 3. Where wiring is involved, new wires shall be “pulled in” between the nearest available accessible reused outlets to the extent allowed by the governing code.
 4. Provide new conduits for wires if they cannot be “pulled in” to existing conduits.
 5. All new conduits, wiring, and electrical items shall be connected to the existing systems so as to function as a complete unit.

6. Where existing electrical equipment, devices, fixtures, electrically operated items, etc., interfere with any remodeling work, they shall be removed and reinstalled in another location to avoid such interferences. All existing and relocated equipment shall be left in good operating condition.
- B. CONTRACTOR shall remove all electrical equipment, conduit, and wiring associated with the structures, equipment, and control systems specified herein and/or shown on the Drawings to be removed.
- C. Bid shall include the removal of existing electrical material and equipment as specified hereinafter, as noted on the drawings, or as needed by field conditions. This includes removal of all conduit and wiring between the existing junction box in each pump house and each pump. The wiring can be re-used from the Aeration Building to each pump house's new required junction box. The new junction box shall be provided with adequate termination strips to accommodate the existing and new wires.
- D. Provide stainless steel cover plates for all existing recessed outlet and junction boxes not being reused. Seal or cap all existing conduit penetrations not being reused.

END OF SECTION

Not to be used for bidding purposes

SECTION 16480

VARIABLE-FREQUENCY DRIVES

PART 1. GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract apply to this Section.
- B. Refer to Section 16000 for general electrical related items.

1.2 SUMMARY

- A. IEEE 519 levels must be met at the PCC described in this Specification.
- B. Section includes separately enclosed, pre-assembled, VFDs, rated 600 V and less, for speed control of three-phase motors. Manufacturer can provide 6-pulse drives with passive harmonic filters in lieu of 18-pulse.
- C. VFDs shall be provided to match the load type of the application, as well as the full load amps of the motors furnished for the project.
- D. This project includes fourteen (14) identical drives each suitable for 8-pole, 23 FLA, 16 Hp motor. One of the drives will initially be used on a 3-phase, 7.5 Hp 9.9 FLA, 6-pole motor and one will initially be used on a 3-phase, 15 Hp 21 FLA, 4-pole motor.

1.3 DEFINITIONS

- A. CPT: Control power transformer.
- B. IGBT: Insulated-gate bipolar transistor.
- C. LED: Light-emitting diode.
- D. PCC: Point of common coupling.
- E. PWM: Pulse-width modulated.
- F. RFI: Radio-frequency interference.
- G. TDD: Total demand (harmonic current) distortion.
- H. THD(V): Total harmonic voltage demand.
- I. VFD: Variable Frequency Drive

1.4 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Product Data: For each type and rating of VFD indicated. Include features, performance, electrical ratings, operating characteristics, shipping and operating weights, and furnished specialties and accessories.

1. Complete system rating including overall drive system operating data, including efficiencies, input current ratings, output current rating, and power factors, at driven equipment actual loads of 0, 40, 60, 80, 100, and 110 percent of rated speed.
2. Maximum heat dissipation from enclosure.
3. Layout of controller face showing pushbuttons, switches, instruments, indicating lights, etc.
4. Complete system interconnection diagrams between controller, DV/DT filter (if used), motor, and all related components or controls external to system, including wire numbers and terminal board point identification.
5. Complete system schematic (elementary) wiring diagrams.

C. Shop Drawings: Include dimensioned plans, elevations, and sections; and conduit entry locations and sizes, mounting arrangements, and details, including required clearances and service space around equipment.

1. Show tabulations of installed devices, equipment features, and ratings. Include the following:
 - a) Each installed unit's type and details.
 - b) Factory-installed devices.
 - c) Enclosure types and details.
 - d) Nameplate legends.
 - e) Short-circuit current (withstand) rating of complete assembly with documentation substantiating rating indicated. The short circuit rating of the assembly shall be greater than the available fault current of the power supply feeding the VFD assembly.
 - f) Features, characteristics, ratings, and factory settings of each VFD and installed devices.
 - g) Specified modifications.
2. Schematic and Connection Wiring Diagrams: For power, signal, and control wiring.

D. Harmonic Analysis Study and Report: Comply with IEEE 399 and NETA Acceptance Testing Specification; identify the effects of nonlinear loads and their associated harmonic contributions on the voltages and currents throughout the electrical system. Analyze possible operating scenarios, including recommendations for VFD input filtering to limit TDD and THD(V) at each VFD to specified levels.

1. Prior to installation, the VFD manufacturer shall provide the estimated total harmonic distortion (THD) caused by the VFD's. The results shall be based on a computer aided circuit simulation of the total actual system, with information obtained from the power service provider and the user.

- E. Source quality-control reports.
- F. Field quality-control reports.

1.5 OPERATION AND MAINTENANCE DATA

- A. VFDs to include in operation and maintenance manuals, in addition to items specified in Section 01300:
 - 1. Manufacturer's written instructions for setting field-adjustable overload relays.
 - 2. Manufacturer's written instructions for testing, adjusting, and reprogramming microprocessor control modules.
 - 3. Manufacturer's written instructions for setting field-adjustable timers, controls, and status and alarm points.
 - 4. Warranty
 - 5. Installation Instruction Manuals.
 - 6. Operation Instruction Manuals.
 - 7. Setup Instruction Manuals.
 - 8. Programming Instruction Manuals.
 - 9. Repair and Preventative Maintenance Manuals.

1.6 QUALITY ASSURANCE

- A. All variable frequency drives shall be by one manufacturer.
- B. For the equipment specified herein, the manufacturer shall be ISO 9001 certified.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Comply with NFPA 70.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. In accordance with Section 01610.
- B. Store VFDs in dry, low humidity location prior to installation.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation, capable of driving full load without de-rating, under the following conditions unless otherwise indicated:
 - 1. Ambient Temperature: Not less than 14°F and not exceeding 104°F.

2. Ambient Storage Temperature: Not less than minus 4°F and not exceeding 140°F.
3. Humidity: Less than 95 percent (noncondensing).
4. Altitude: Not exceeding 3000 feet.

1.9 COORDINATION

- A. Coordinate features of motors, load characteristics, installed units, and accessory devices to be compatible with the following:
 1. Torque, speed, and horsepower requirements of the load.
 2. Ratings and characteristics of supply circuit and required control sequence.
 3. Ambient and environmental conditions of installation location.
 4. Coordinate sizes and locations of wall mounted equipment supports with actual equipment provided.

1.10 SPARE PARTS

- A. No spare parts are required.

1.11 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace VFDs that fail in materials or workmanship within specified warranty period.
- B. Warranty Period: Six years from date of Substantial Completion.
- C. The warranty shall include parts, labor, travel, and all associated living expenses incurred by the manufacturer to provide factory authorized on-site service. The warranty shall be provided by the VFD manufacturer.

PART 2. PRODUCTS

2.1 MANUFACTURED UNITS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Danfoss Inc.; Model VLT Aqua Drive FC-202 with MCB105 card.
 2. ABB; Model ACQ580.
- B. General Requirements for VFDs: Comply with NEMA ICS 7, NEMA ICS 61800-2, and UL 508C.
- C. Application: Variable torque.
- D. VFD Description: Variable-frequency power converter (rectifier, dc bus, and IGBT, PWM inverter) factory packaged in a wall mount enclosure, with integral

overcurrent and overload protection; listed and labeled by an NRTL as a complete unit; arranged to provide self-protection, protection, and variable-speed control of one three-phase induction motor by adjusting output voltage and frequency. The solid state VFD shall employ a full wave rectifier, AC input / output Line Reactors (dual DC link reactors acceptable), capacitors, and IGBT's as the output switching device.

1. Units suitable for operation of motors as defined here-in.
 2. Listed and labeled for integrated short-circuit current (withstand) rating by an NRTL acceptable to authorities having jurisdiction.
- E. Design and Rating: Match load type, all drives to be suitable for pumps; and type of connection used between motor and load such as through a power-transmission connection.
- F. Output Rating: Three-phase; 10 to 60 Hz, with voltage proportional to frequency throughout voltage range; maximum voltage equals input voltage.
- G. Unit Operating Requirements:
1. Input AC Voltage Tolerance: 480 Vac plus 10 and minus 10 percent.
 2. Input AC Voltage Unbalance: Not exceeding 5 percent.
 3. Input Frequency Tolerance: 60 Hz plus or minus 3 percent.
 4. Minimum Efficiency: 97 percent at 60 Hz, full load.
 5. Minimum Displacement Primary-Side Power Factor: 98 percent under any load or speed condition.
 6. Minimum Short-Circuit Current (Withstand) Rating: 100 kA.
 7. Vibration Withstand: Comply with IEC 60068-2-6.
 8. Heavy-duty Overload Rating: 1.1 times the base load current for 60 seconds; minimum of 1.8 times the base load current for three seconds.
 9. Starting Torque: Minimum 100 percent of rated torque from 3 to 60 Hz.
 10. Speed Regulation: Plus or minus 10 percent.
 11. Output Carrier Frequency: Selectable; 0.5 to 8 kHz. In addition, the output carrier frequency shall be randomly modulated about the selected frequency.
 12. Stop Modes: Programmable.
 13. Units shall be capable of operating attached to the same power bus without affecting each other's operations. If operational problems occur, an isolation transformer shall be added to each drive at no additional Contract cost.
 14. Provide line reactors and/or filtering as needed for supplied VFDs to meet the harmonic distortion requirements of IEEE-519 at the MCC powering the VFDs.

- H. Inverter Logic: Microprocessor based, isolated from all power circuits.
- I. Isolated Control Interface: Allows VFDs to follow remote control signal over a minimum 40:1 speed range.
- J. Internal Adjustability Capabilities:
1. Minimum Speed: 5 to 25 percent of maximum rpm.
 2. Maximum Speed: 80 to 110 percent of maximum rpm.
 3. Acceleration: 0.1 to 999.9 seconds.
 4. Deceleration: 0.1 to 999.9 seconds.
 5. Current Limit: 30 to minimum of 150 percent of maximum rating.
- K. Self-Protection and Reliability Features:
1. Input transient protection by means of surge suppressors to provide three-phase protection against damage from supply voltage surges 10 percent or more above nominal line voltage.
 2. Loss of Input Signal Protection: Selectable response strategy, including speed default to a percent of the most recent speed, a preset speed, or stop; with alarm.
 3. Under- and over-voltage trips.
 4. Inverter overcurrent trips.
 5. VFD and Motor Overload/Overtemperature Protection: Microprocessor-based thermal protection system for monitoring VFDs and motor thermal characteristics, and for providing VFD overtemperature and motor overload alarm and trip; settings selectable via the keypad; NRTL approved.
 6. Critical frequency rejection, with selectable, adjustable deadbands.
 7. Instantaneous line-to-line and line-to-ground overcurrent trips.
 8. Reverse-phase protection.
 9. Short-circuit protection.
 10. Motor overtemperature fault.
 11. Ground fault.
 12. The VFD control circuitry shall be protected from sustained power or phase loss. This protection shall utilize an under-voltage relay located on the secondary side of the 120-volt AC control power transformer and be set to deactivate all power circuitry if the voltage drops below the safe operating range (95 volts AC) of the mechanical contractors.
- L. Automatic Reset/Restart: Attempt three restarts after drive fault or on return of power after an interruption and before shutting down for manual reset or fault correction; adjustable delay time between restart attempts.

- M. Torque Boost: Automatically varies starting and continuous torque to at least 1.5 times the minimum torque to ensure high-starting torque and increased torque at slow speeds.
- N. Motor Temperature Compensation at Slow Speeds: Adjustable current fall-back based on output frequency for temperature protection of self-cooled, fan-ventilated motors at slow speeds.
- O. The controller's full load output current rating shall be based on 40° ambient temperature.
- P. The drive shall employ a current limit circuit to provide trip free operation and shall have the capability to be set between 40 and 110 percent of the drive controller output. The current limit shall be able to be set either manually via the keypad, by a frequency level, by a logic input, or by an analog input.
- Q. The VFD shall be optimized for a 4 kHz carrier frequency to reduce motor noise and provide high system efficiency. The carrier frequency shall be adjustable by the start-up engineer or the drive shall have the capability to inject a white noise down the motor leads to reduce motor noise.
- R. Galvanic and/or optical isolation shall be provided between the drive's power circuitry and control circuitry to ensure operator safety and to protect connected electronic control equipment from damage caused by voltage spikes, current surges, and ground loop currents. Drives not including isolation on both analog I/O and discreet I/O shall include additional isolation modules as manufactured by Action Instruments, Inc.
- S. 120 Vac control to allow VFD to interface with remote dry contacts.

2.2 CONTROLS AND INDICATION

- A. Panel-Mounted Operator Station: Manufacturer's standard front-accessible, sealed keypad and plain-English language digital display; allows complete programming, program copying, operating, monitoring, and diagnostic capability.
 - 1. Keypad: In addition to required programming and control keys.
 - 2. Security Access: Provide electronic security access to controls through identification and password with at least three levels of access: View only; view and operate; and view, operate, and service.
 - a) Control Authority: Supports at least four conditions: Off, local manual control at VFD, local automatic control at VFD, and automatic control through a remote source.
- B. Historical Logging Information and Displays:
 - 1. Real-time clock with current time and date.
 - 2. Running log of total power versus time.
 - 3. Total run time.
 - 4. Fault log, maintaining last four faults with time and date stamp for each.

C. Indicating Devices: Digital display mounted flush in VFD door and connected to display VFD parameters including, but not limited to:

1. Output frequency (Hz).
2. Motor speed (rpm).
3. Motor status (running, stop, fault).
4. Motor current (amperes).
5. Fault or alarming status (code).
6. Motor output voltage (V ac)

D. Control Signal Interfaces:

1. Electric Input Signal Interface:

2. Inputs: A minimum of six (6) programmable digital inputs, two (2) analog inputs and serial communications interface shall be provided with the following available as a minimum:

- a) Remote manual/auto
- b) Remote start/stop
- c) Remote forward/reverse
- d) Remote preset speeds
- e) Remote external trip
- f) Remote fault reset
- g) Process control speed reference interface, 4-20m Adc
- h) Potentiometer and 0-10 Vdc speed reference interface
- i) Fixed frequencies using digital inputs.
- j) RS-232 programming and operation interface port
- k) Serial communications capability

3. Outputs: A minimum of two (2) discrete programmable digital outputs, one (1) programmable open collector output, and one (1) programmable analog output shall be provided, with the following available at minimum:

a) Programmable relay outputs with one (1) set of form C contacts for each, selectable with the following available at minimum:

- (1) Fault
- (2) Run
- (3) Ready
- (4) Reversing
- (5) Jogging

- (6) At speed
 - (7) In torque limit
 - (8) Motor rotation direction opposite of commanded
 - (9) Over-temperature.
4. Programmable open collector output with available 24 Vdc power supply and selectable with the following available at minimum:
- a) Fault
 - b) Run
 - c) Ready
 - d) Reversing
 - e) Jogging
 - f) At speed
 - g) In torque limit
 - h) Motor rotation direction opposite of commanded
 - i) Over-temperature.
5. Programmable analog output signal, selectable with the following available at minimum:
- a) Output current
 - b) Output frequency
 - c) Motor speed
 - d) Motor torque
 - e) Motor power
 - f) Motor voltage
 - g) DC link voltage
6. Monitoring and Displays:
- a) The VFD keypad shall be capable of displaying the manufacturer's standard monitoring functions which should include:
 - (1) Output frequency
 - (2) Output speed
 - (3) Motor current
 - (4) Motor torque
 - (5) Motor power
 - (6) Motor voltage

- (7) DC-link voltage
- (8) Heatsink temperature
- (9) Total operating days counter
- (10) Operating hours (with reset function)
- (11) Total megawatt hours
- (12) Megawatt hours (with reset function)
- (13) Voltage level of analog input
- (14) Current level of analog input
- (15) Digital inputs status
- (16) Digital and relay outputs status
- (17) Motor temperature rise, percentage of allowable.

7. Protecting Functions:

a) The VFD shall include the manufacturer's standard protective features which should include:

- (1) Over-current
- (2) Over-voltage
- (3) Inverter fault
- (4) Under-voltage
- (5) Phase loss
- (6) Output phase loss
- (7) Under-temperature
- (8) Over-temperature
- (9) Motor stalled
- (10) Motor over-temperature
- (11) Motor under-load
- (12) Logic voltage failure
- (13) Microprocessor failure
- (14) DC injection braking.

b) The VFD shall provide ground fault protection during power-up, starting, and running. VFD with no ground fault protection during running are not acceptable.

- E. Three (3) programmable critical frequency lockout ranges to prevent the VFD from continuously operating at an unstable speed.
- F. Four (4) programmable preset speeds.

- G. The VFD shall Ramp or Coast to a stop, as selected by the user.
- H. For pump applications, the acceleration and deceleration profile shall be an S-curve to avoid abrupt speed changes.

2.3 LINE CONDITIONING AND FILTERING

- A. Based on the harmonic analysis study and report, the VFD shall be provided with line-side harmonic reduction, as required, to insure that the current distortion limits, as defined in table 10.3 of IEEE 519-1992, are met. PCC1, defined as the low voltage side of the distribution transformer, is used for purposes of calculation and referred, by the turns ratio of the transformer, to the PCC defined by the IEEE Recommended Practices as the Consumer-Utility interface. The tables of limits set forth therein are with reference to the PCC ($I_{sc}/I_l < 20$). This can be done by utilizing 18-pulse drives or 6-pulse drives with passive harmonic filters. Passive harmonic filters can be provided by the following manufacturer's:
 - 1. Danfoss Inc.; Danfoss Drives Div.
 - 2. MTE Series D Harmonic Filter.
 - 3. Mirus International
- B. Harmonic solutions shall be designed to withstand up to 2% line imbalances with the maximum Current Distortion not to exceed 11% at 100% load.
- C. Harmonic solutions shall be capable of withstanding up to 2% ambient voltage distortion with the maximum Current Distortion not to exceed 12% at 100% load.
- D. To ascertain the harmonic contribution of the VFD's at the PCC and to show compliance with IEEE 519-1992, harmonic analysis shall be performed and submitted. EMI/RFI Filtering: CE marked; certify compliance with IEC 61800-3 for Category C2.
 - 1. kVA rating of the low voltage distribution transformer(s)
 - 2. X/R Ratio of utility low voltage distribution transformer(s)
 - 3. Primary voltage
 - 4. Secondary voltage
 - 5. Secondary %IZ (impedance)
 - 6. Length, size, & number of conductors between transformer LV side and distribution panel
 - 7. System Single Line Diagram and electrical equipment list showing transformer and VFD detail
 - 8. Total linear load kW to be connected to the distribution transformer
 - 9. Anticipated maximum demand load (15 minute or 30 minute) on the distribution transformer (IEEE 519)
- E. The use of twelve-pulse rectifiers, Active filters, or Active converter sections is not acceptable.

- F. The VFD shall provide internal DC link reactors to when needed to minimize power line harmonics and to provide near unity power factor. DC Link reactor shall be installed so that power fluctuations to the DC Capacitors shall be reduced to increase Capacitor life. VFD's without a DC link reactor shall provide a 3% impedance line side reactor and provide spare capacitors.

2.4 ENCLOSURES

- A. Provide single enclosure for all components of each VFD. If needed, line reactors and filters can be in separate wall mounted enclosures with required conduit and wiring provided by the Contractor.
- B. VFD Enclosures: NEMA 250, to comply with environmental conditions at installed location. Indoor Dry and Clean Locations: Type 1, filtered and gasketed.
- C. Required Dimension Restrictions: Enclosure shall be designed to fit in the wall space as shown, above the existing modified panel after removal of old VFD.

2.5 ACCESSORIES

- A. Control Relays: Auxiliary and adjustable solid-state time-delay relays.
- B. Phase-Failure, Phase-Reversal, and Under-voltage and Over-voltage Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connections. Provide adjustable under-voltage, over-voltage, and time-delay settings. Current Transformers: Continuous current rating, basic impulse insulating level (BIL) rating, burden, and accuracy class suitable for connected circuitry. Comply with IEEE C57.13.

2.6 SOURCE QUALITY CONTROL

- A. Testing: Test and inspect VFDs according to requirements in NEMA ICS 61800-2. Test each VFD while connected to a motor that is comparable to that for which the VFD is rated.
- B. VFDs will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

PART 3. EXECUTION

3.1 EXAMINATION

- A. Examine areas, surfaces, and substrates to receive VFDs, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine VFD before installation. Reject VFDs that are wet, moisture damaged, or mold damaged.
- C. Examine roughing-in for conduit systems to verify actual locations of conduit connections before VFD installation.

- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 HARMONIC ANALYSIS STUDY

- A. Perform a harmonic analysis study to identify the effects of nonlinear loads and their associated harmonic contributions on the voltages and currents throughout the electrical system. Analyze possible operating scenarios, including recommendations for VFD input filtering to limit TDD and THD(V) at each VFD to specified levels.
- B. Prepare a harmonic analysis study and report complying with IEEE 399 and NETA Acceptance Testing Specification.

3.3 FACTORY TESTING

- A. The following standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of UL and NEMA standards.
 1. All printed circuit boards shall be functionally tested via automatic test equipment prior to unit installation.
 2. All inverter power sub-assemblies shall undergo a burn-in test.
 3. After all pre-tests have been performed, each complete VFD shall undergo a burn-in test. The drive shall be burned in with a motor load without an unscheduled shutdown.
- B. Manufacturer shall provide certified copies of complete VFD final test reports.

3.4 INSTALLATION

- A. Coordinate layout and installation of VFDs with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Wall-Mounting Controllers: Install VFDs on walls with tops at uniform height and with disconnect operating handles not higher than seventy-two (72) inches above finished floor unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall.
- C. The contractor shall complete all wiring in accordance with the recommendations of the VFD manufacturer as outlined in the installation manual.
- D. A remote disconnect at the motor is provided for each pump motor controlled by an adjustable frequency drive, coordinate with the supplier of the disconnects to ensure that a late make, early break auxiliary contact rated for ten (10) amps continuous duty is provided on the disconnect. This auxiliary contact shall be wired into the VFD emergency shutdown (coast to stop) circuit to ensure shutdown of the VFD in the event of the remote disconnect being opened. Damages resulting from equipment failures due to omission of this safety device shall be the responsibility of the Contractor providing the VFD. Provide the required control wiring between the disconnect switch and VFD.

- E. Install fuses in control circuits if not factory installed.
- F. Install, connect, and fuse thermal-protector monitoring relays furnished with motor-driven equipment.
- G. Comply with NECA 1.

3.5 STARTUP SERVICE

- A. The manufacturer shall provide start-up commissioning of the VFD and its optional circuits by a factory certified service technician who is experienced in start-up and repair services. The commissioning personnel shall be the same personnel that will provide the factory service and warranty repairs at the customer's site. Start-up services shall include checking for verification of proper operation and installation for the VFD, its options, and its interface wiring to the building automation system. Include a copy of the Start-Up Report in the close-out documents. Two (2) VFDs will be started at a time. Manufacturer shall provide a minimum of one trip for every four (4) VFD's or more as required to ensure proper start-up and operation of the equipment.
- B. The start-up report shall include the following information in addition to the manufacturer's standard information:
 - 1. Low speed limit points as defined by BAS or pump manufacturer's representative.
 - 2. Motor amp and kW at low limit and high limit speeds.
 - 3. Acceleration and deceleration settings.

3.6 ADJUSTING

- A. Program microprocessors for required operational sequences, status indications, alarms, event recording, and display features. Clear events memory after final acceptance testing and prior to Substantial Completion.
- B. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.
- C. Adjust the trip settings of MCPs and thermal-magnetic circuit breakers with adjustable, instantaneous trip elements. Initially adjust to six times the motor nameplate full-load amperes and attempt to start motors several times, allowing for motor cool-down between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify Engineer before increasing settings.
- D. Set the taps on reduced-voltage autotransformer controllers.

3.7 PROTECTION

- A. Replace VFDs whose interiors have been exposed to water or other liquids.

3.8 DEMONSTRATION

- A. Engage a factory service representative to train Owner's personnel to adjust, operate, reprogram, and maintain VFDs at time of equipment commissioning.

END OF SECTION

Not to be used for bidding purposes

Not to be used for bidding purposes

Section II
Contract Forms

Proposal

Project: RAS Pump Replacement Phase 2, Capital Project No. 1859

Location: 3333 Kishwaukee Street, Rockford, Illinois

Completion Date: Substantial completion (all ten new pumps installed and fully functional) shall be July 15, 2020. Final completion shall be July 31, 2020.

Liquidated Damages: \$300/calendar day per each completion date deadline

To: Board of Trustees
Rock River Water Reclamation District
3501 Kishwaukee Street
Rockford, IL 61109

From: _____
(Individual, Partnership or Corporation, as case may be)

(Address of Individual, Partnership or Corporation)

Gentlemen:

I (We), the undersigned, hereby propose to furnish all materials, equipment, tools, services, labor, and whatever else may be required to construct and place in service the above subject Sanitary Sewer for the Rock River Water Reclamation District all in accordance with the plans and specifications, provided by the Rock River Water Reclamation District. The undersigned also affirms and declares:

1. That I (we), have, examined and am (are) familiar with all the related contract documents and found that they are accurate and complete and are approved by the undersigned.
2. That I (we), have carefully examined the site of the work, and that, from my (our) investigation, has satisfied myself (ourselves) as to the nature and location of the work, the character, quality, and quantity of materials and the kind and extent of equipment and other facilities needed for the performance of the work, the general and local conditions and all difficulties to be encountered, and all other items which may, in any way, effect the work or its performance.
3. That this bid is made without any understanding, agreement or connection with any other person, firm, or corporation making a bid for the same purposes, and is in all respects fair and without collusion or fraud; and that I (we) are not barred from bidding as a result of a bid-rigging or bid-rotating conviction.

4. That accompanying the Proposal is a Bidder's Bond in the amount specified in Article 1, Notice to Bidders, payable to the Board of Trustees of the Rock River Water Reclamation District, which it is agreed, shall be retained as liquidated damages by said Rock River Water Reclamation District if the undersigned fails to execute the Contract in conformity with the contract documents incorporated in the contract documents and furnish bond as specified, within ten (10) days after notification of the award of the contract to the undersigned.
5. The Bidder is of lawful age and that no other person, firm or corporation has any interest in this Proposal or in the Contract proposed to be entered into.
6. The Bidder is not in arrears to the Rock River Water Reclamation District, upon debt or contract, and is not a defaulter, as surety or otherwise, upon any obligation to the Rock River Water Reclamation District.
7. No officer or employee or person whose salary is payable in whole or in part by the District is, shall be or become interested, directly or indirectly as a contracting party, partner, stockholder, surety or otherwise, in this Proposal, or in the performance of the Contract, or in the work to which it is relates, or in any portion of the profits thereof.
8. The Bidder which I represent complies with all applicable requirements of the Americans with Disabilities Act (ADA) and the Occupational Safety and Health Act (OSHA) and that if said bidder is awarded a contract, it will complete all OSHA-required or ADA-required employee and customer training, will make available all required information, and will hold harmless and indemnify the District and the District's representatives.

In regard to participation in an approved Apprenticeship program, upon request, Contractor will be required to provide written proof of participation.

9. The undersigned, as Bidder, declares that he has adopted and promulgated written sexual harassment policies in accordance with Public Act 99-093 and will make this information available upon request.
10. The undersigned, as Bidder, declares he will comply with prevailing wages in accordance with the Illinois Department of Labor Standards. The State of Illinois requires contractors and subcontractors on public works projects (including the Rock River Water Reclamation District) to submit certified payroll records on a monthly basis, along with a statement affirming that such records are true and accurate, that the wages paid to each worker are not less than the required prevailing rate and that the contractor is aware that filing false records is a Class B Misdemeanor. The successful Bidder shall be responsible for verifying the prevailing wages each month and notifying all subcontractors of the appropriate monthly rates. Prevailing wage rates may be found on the Illinois Department of Labor website at www.illinois.gov/idol/Laws-Rules/CONMED/Pages/Rates.aspx .

The certified payroll records must include the name, address, telephone number, social security number, job classification, hourly wages paid in each pay period, the number of hours worked each day, and the starting and ending time of work each day, for every worker employed on the project. Any contractor who fails to submit a certified payroll or knowingly files a false certified payroll is guilty of a Class B Misdemeanor. Certified payroll reports shall be submitted on industry standard forms such as IDOT Statement of Compliance (SBE 348) or other approved equal.

11. The undersigned, as Bidder, declares he will comply with the Federal Drug Free Workplace Act.
12. The undersigned, as Bidder, declares he will comply with Public Act 83-1030 entitled "Steel Products Procurement Act".
13. The undersigned, as Bidder, declares he will comply with Public Act 96-929 (30 ILCS 570) regarding Illinois residents' employment.
14. The undersigned, as Bidder, declares he will comply with non-discrimination in employment in accordance with the Illinois Fair Employment Practices Commissions Rules & Regulations.
15. The undersigned, as Bidder, declares that he currently participates in an apprenticeship or training program that is registered with the United States Department of Labor's Bureau of Apprenticeship and Training or other acceptable State of Illinois Department of Labor monitored program.

In submitting this bid, it is understood that the right is reserved by the Rock River Water Reclamation District to reject any and all bids. It is agreed that this bid may not be withdrawn for a period of sixty (60) days from the opening thereof.

The undersigned further declares that he (they) has (have) carefully examined the following items of work and that the cost of all the work to complete this project is given in this Proposal.

Not to be used for bidding purposes

Lump Sum Bid Amount

Total Amount of Lump Sum Bid, expressed in figures, for providing all materials, equipment, warranty, and labor to complete this project in conformity with all specifications in this Invitation to Bid.

\$ _____

The undersigned acknowledges that he has received Addendum numbers _____, _____, _____, _____, and realizes that all Addenda are considered part of the Contract.

Date: _____

Bidder: _____

(Printed Name of Firm)

By: _____

(Authorized Rep's Signature)

(Printed Street Address)

By: _____

(Printed Authorized Rep's Name)

(Printed City, State, Zip)

By: _____

(Printed Authorized Rep's Title)

(Area Code and Phone Number)

By: _____

(Fax Number)

(Authorized Rep's Email Address)

Not to be used for bidding purposes

Fair Employment Practices Affidavit of Compliance

Project: RAS Pump Replacement Phase 2, Capital Project No. 1859

NOTE: THE BIDDER MUST EXECUTE THIS AFFIDAVIT AND SUBMIT IT WITH ITS SIGNED BID. THE ROCK RIVER WATER RECLAMATION DISTRICT CANNOT ACCEPT ANY BID WHICH DOES NOT CONTAIN THIS AFFIDAVIT

_____, being first duly sworn, deposes and says that:
(Name of person making affidavit)

They are: _____ of _____
(Officer's Title) (Company Name)

that said company is and "Equal Opportunity Employer" as defined by Section 2000(e) of Chapter 21, Title 42 of the United States Code annotated and Federal Executive Orders #11375 which are incorporated herein by reference;

and that said company will comply with any and all requirements of Title 44 Admin. Code 750. APPENDIX A – Equal Opportunity Clause, Rules and Regulations, Illinois Department of Human Rights, which read as follows:

"In the event of the contractor's non-compliance with the provisions of this Equal Employment Opportunity Clause, the Illinois Human Rights Act or the Rules and Regulations of the Illinois Department of Human Rights ("Department"), the contractor may be declared ineligible for future contracts or subcontracts with the State of Illinois or any of its political subdivisions or municipal corporations, and the contract may be cancelled or voided in whole or in part, and such other sanctions or penalties may be imposed or remedies invoked as provided by statute or regulation. During the performance to this contract, the contractor agrees as follows:

1. That it will not discriminate against any employee or applicant for employment because of race, color, religion, sex, sexual orientation, marital status, national origin or ancestry, citizen status, age, physical or mental handicap unrelated to ability, sexual orientation, military status or an unfavorable discharge from military service; and further that it will examine all job classifications to determine if minority persons or women are underutilized and will take appropriate affirmative action to rectify any such underutilization.
2. That, if he or she hires additional employees in order to perform this contract or any portion of this contract, he or she will determine the availability (in accordance with the Department's Rules and Regulations) of minorities and women in the areas from which he or she may reasonably recruit and he or she will hire for each job classification for which employees are hired in a way that minorities and women are not underutilized.
3. That, in all solicitations or advertisements for employees placed by him or her or on his or her behalf, he or she will state that all applicants will be afforded equal opportunity without discrimination because of race, color, religion, sex, sexual orientation, marital status, national origin or ancestry, citizenship status, age, physical or mental handicap unrelated to ability, sexual orientation, military status or an unfavorable discharge from military service.
4. That he or she will send to each labor organization or representative of workers with which he or she has or is bound by a collective bargaining or other agreement or understanding, a notice advising such labor organization or representative of the contractor's obligations under the Illinois Human Rights Act and the Department's Rules and Regulations. If any labor organization or representative fails or refuses to cooperate with the contractor in his or her efforts to comply with such Act and Rules and Regulations, the contractor will promptly so notify the Department and the contracting agency and will recruit employees from other sources when necessary to fulfill its obligations under the contract.
5. That he or she will submit reports as required by the Department's Rules and Regulations, furnish all relevant information as may from time to time be requested by the Department or the contracting agency, and in all respects comply with the Illinois Human Rights Act and the Departments Rules and Regulations.
6. That he or she will permit access to all relevant books, records, accounts and work sites by personnel of the contracting agency and the Department for purposes of investigation to ascertain compliance with the Illinois Human Rights Act and the Department's Rules and Regulations.
7. That he or she will include verbatim or by reference the provisions of this clause in every subcontract awarded under which any portion of the contract obligations are undertaken or assumed, so that the provisions will be binding upon the subcontractor. In the same manner as with other provisions of this contract, the contractor will be liable for compliance with applicable provisions of this clause by such subcontractors; and further it will promptly notify the contracting agency and the Department in the event any subcontractor fails or refuses to comply with the provisions. In addition, the contractor will not utilize any subcontractor declared by the Illinois Human Rights Commission to be ineligible for contracts or subcontracts with the State of Illinois or any of its political subdivisions or municipal corporations.

(Source: Amended at 32 I11. Reg. 16484, effective September 23, 2008)"

IL Dept of Human Rights Registration No.: _____ Expiration Date: _____

Signature

Subscribed and sworn to before me this _____ day of _____, 20_____.

Notary Public

Bid Bond

KNOW ALL MEN BY THESE PRESENTS, that we:

_____ (hereinafter called the Principal) and

_____ (hereinafter called the Surety)

a Corporation chartered and existing under the laws of the State of _____ with its principal offices in the City of _____ and authorized to do business in the State of Illinois are held and firmly bound onto the Rock River Water Reclamation District of Winnebago County, Illinois (District), in the full and just sum of: FIVE PERCENT (5%) OF THE TOTAL BID PRICE good lawful money of the United States of America, to be paid upon demand of the District, to which payment will and truly to be made we bind ourselves, our heirs, executors, administrators, and assigns, jointly and severally and firmly by these presents.

WHEREAS, the Principal is about to submit, or has submitted to the District, a proposal for constructing Sanitary Sewers and Appurtenances.

WHEREAS, the Principal desires to file this bond, in accordance with law, to accompany this Proposal.

NOW THEREFORE, The conditions of this obligation are such that if the Proposal be accepted, the Principal shall, within ten days after the date of receipt of a written notice of award of Contract, execute a Contract in accordance with the Proposal and upon the terms, conditions, and prices set forth therein, in the form and manner required by the District, and execute a sufficient and satisfactory Contract Performance Bond payable to said District in an amount of one hundred percent (100%) of the Contract price (including alternates) in form and with security satisfactory to said District, then this obligation to be void, otherwise to be and remain in full force and virtue in law; and the Surety shall, upon failure of the Principal to comply with any or all of the foregoing requirements within the time specified above, immediately pay to the aforesaid District, upon demand, the amount hereof in good and lawful money of the United States of America, not as a penalty, but as liquidated damages.

IN TESTIMONY THEREOF, the Principal and Surety have caused these presents to be duly signed and sealed this ____ day of _____, 20__.

Principal

(Seal)

By _____

Name: _____

Title: _____

Date: _____

ATTEST:

Secretary

Surety

(Seal)

By _____

Name: _____

Title: _____

Date: _____

Not to be used for bidding purposes

Agreement

1. General

THIS AGREEMENT, made and concluded this ____ day of _____, 2019, between the Rock River Water Reclamation District, Rockford, Illinois (District), acting by and through the Board of Trustees, and _____, his/their executors, administrators, successors or assigns:

2. Scope of Work

WITNESSETH: That for and in consideration of the payments and agreements made in the Proposal attached hereto, to be made and performed by the District and according to the terms expressed in the Bond referring to these presents, the Contractor agrees with the District at his/their own proper cost and expense to do all the work, furnish all equipment, materials and all labor necessary to complete the work in accordance with the plans and specifications hereinafter described, and in full compliance with all of the terms of this agreement and the requirements of the District and its representative.

And it is also understood and agreed that the Bidding Requirements, Detailed Specifications, Contract Forms, General Conditions, General Requirements, Technical Specifications, Plans, Addenda, and provisions required by law are all essential documents of the contract, and are a part hereof, as if herein set out verbatim or as if attached, except for titles, subtitles, headings, table of contents and portions specifically excluded.

3. Contract Price

The District shall pay to the Contractor, and the Contractor shall accept, in full payment for the performance of this Contract, subject to any additions or deductions provided for hereby, in current funds, the Total Contract Price of _____ and 00/100 (\$_____).

Payments are to be made to the Contractor in accordance with and subject to the provisions of Section 7 of this Agreement, which is a part of this Contract.

4. Bond

The Contractor has entered into and herewith tenders a bond of even date herewith, in the penal sum of _____ and 00/100 (\$_____) to insure the faithful performance of this Contract, which said bond is hereby made a part of this Contract by reference.

5. Maintenance and Guarantee

The Contractor shall promptly repair, replace, restore or rebuild any imperfections that may arise and shall maintain satisfactory to the District all work for a period three (3) years from the date of final acceptance of the Contract for trench settlement and for a period of two (2) years all other work, except where periods of maintenance and guarantee are provided for. The Contractor shall,

for this period, indemnify and save harmless the District, its officers and agents from any injury done to property or persons as a direct or alleged result of imperfections in the Contractors' work, and shall immediately assume and take charge of the defense of such action or suits in like manner and to all intents and purposes as if said actions and suits had been brought directly against the Contractor.

If the Contractor shall fail to repair, replace, rebuild or restore such defective or damaged work promptly after receiving notice given by the District, the District shall have the right to have the work done by others and to call on the Contractor and his bondsman to pay the costs thereof.

6. Contract Execution

IT IS EXPRESSLY UNDERSTOOD AND AGREED that the entire improvement shall be done in a thorough and workmanlike manner, under the direction and to the satisfaction of the District and in full compliance with all the requirements of its representative under them. All loss or damage arising out of the nature of the work to be done, or from any detention of unforeseen obstruction or difficulty which may be encountered in the prosecution of the work, or from the action of the elements, shall be sustained by the Contractor.

The Contractor will be held responsible for all accidents, and hereby agrees to indemnify and protect the District from all suits, claims, and actions brought against it, and all cost, and damages which the District may be put to by reason of an injury or alleged injury, to the person or property of another in the execution of this Contract, or the performance of the work, or in guarding the same, or for any material used in its prosecution or in its construction.

Any person employed on the work who shall refuse or neglect to obey the directions of the District or its representative, or who shall be deemed by the District to be incompetent, or who shall be guilty of any disorderly conduct, or who shall commit any trespass on any public or private property in the vicinity of the work, shall at once be removed from the work by the Contractor when so requested by the District.

Any request to extend the contract completion date must be considered by the Board at the Board meeting prior to the then-existing contract termination date. Any deviation from this action will result in the liquidated damage clause in the contract to be exercised.

7. Payments to Contractor

The District hereby covenants and agrees, in consideration of the covenants and agreements in this Contract, specified to be kept and performed by the Contractor and subject to the conditions herein contained, and if the District receives an acceptable invoice prior to the tenth day of the month and receives approval of the work by the District Engineering Manager, the District shall issue payment before the fifth day of the succeeding month. If the District receives an acceptable invoice on or after the tenth day of the month, the District shall issue payment before the fifth day of the second succeeding month.

The District reserves the right at all times to refuse to issue payment in case the Contractor has neglected or failed to pay any subcontractors, workmen or employee on the work.

8. Subcontracts

No part of the work herein provided for shall be sublet or subcontracted without the express consent of the District, to be entered in the records, and in no case shall consent relieve the Contractor from the obligation herein entered into, or change the terms of this Agreement.

9. Contractor's Responsibility

This Contract shall extend to and be binding upon the successors and assigns, and upon the heirs, administrators, executors, and legal representatives of the Contractor.

In consideration of and to induce the award of this Contract to him, the Contractor represents and warrants: that he is not in arrears to the District upon debt of the Contract and that he is not a defaulter, as surety, contractor or otherwise; that he is financially solvent and sufficiently experienced and competent to perform the work; that the work can be performed as called for by the Contract; that the facts stated in his proposal and the information given by him is true and correct in all respects, and that he is fully informed regarding all the conditions affecting the work to be done and labor and materials to be furnished for the completion of this Contract and that his information was secured by personal investigation and research.

The Contractor shall pay not less than the prevailing wage rate as determined by the Department of Labor, to all laborers, workmen and mechanics performing work under this Contract. Contractor shall comply with current revisions of the wage standards; as required by law. The Contractor shall be responsible for verifying the prevailing wages each month and notifying all subcontractors of the appropriate monthly rates. Certified payroll reports shall be submitted on industry standard forms such as IDOT Statement of Compliance (Form SBE 348).

In regard to nondiscrimination in employment, Contractor will be required to comply with the Illinois Fair Employment Practices Commission's Rules and Regulations as provided herein.

The Contractor shall comply with the American Disabilities Act of 1990 (ADA). The Contractor will hold harmless and indemnify the District and their representatives from all:

- (a) suits, claims, or actions;
- (b) costs, either for defense (including but not limited to reasonable attorney's fees and expert witness fees) or for settlement, and;
- (c) damages of any kind (including but not limited to actual, punitive, and compensatory damages)

relating in any way to or arising out of the ADA, to which said firm is exposed or which it incurs in the execution of the contract.

Contractor shall also comply with Public Act 99-0933, which requires any party to a contract to adopt and enforce a written policy regarding sexual harassment that includes, as a minimum, the following information:

- (a) the illegality of sexual harassment
- (b) the definition of sexual harassment under Illinois State law;
- (c) a description of sexual harassment, utilizing examples;
- (d) my (our) organization's internal complaint process including penalties;
- (e) through the Illinois Department of Human Rights and the Illinois Human Rights Commission;

- (f) directions on how to contact the Department and the Commission; and
- (g) protection against retaliation as provided by Section 6-101 of the Illinois Human Rights Act.

Upon request this information will be provided to the Illinois Department of Human Rights. Upon District award of a contract, the District will be provided this information described no more than ten working days after the District issues its award notification.

The Contractor shall comply with Article 2 of Public Act 83-1472 which provides that Illinois residents be employed on Illinois public works projects, provided there has been a period of excessive unemployment (5%) in the State of Illinois as defined in the Act; and further, that Illinois workers are available and capable of performing the particular type work involved.

The Contractor shall comply with all rules and regulations of OSHA during the execution of this Contract.

The Contractor shall comply with the Federal Drug Free Workplace Act.

The Steel Products Procurement Act, Illinois Public Act 83-1030, requires that steel products used or supplied in performance of this Contract or subcontract shall be manufactured or produced in the United States with three exceptions, as explained in the Instructions to Bidders.

The Contractor shall comply with Public Act 96-1416 regarding the disposal of CCDD and uncontaminated soil at CCDD fill sites as explained in the Instructions to Bidders.

10. Time

Work under this Agreement shall be commenced upon written Notice to Proceed. Substantial completion (all ten (10) new pumps installed and fully functional) shall be July 15, 2020. Final completion shall be July 31, 2020.

11. Liquidated Damages

The amount of liquidated damages shall be \$300.00 per calendar day for each completion date.

12. Counterparts

This Agreement may be executed and recorded in counterparts, each of which shall be deemed an original and all of which, when taken together, shall constitute one and the same instrument. The Parties hereby acknowledge and agree that facsimile signatures or signatures transmitted by electronic mail in so-called "pdf" format shall be legal and binding and shall have the same full force and effect as if an original of this Agreement had been delivered. Each of the parties (a) intend to be bound by the signatures on any document sent by facsimile or electronic mail, (b) are aware that the other party will rely on such signatures, and (c) hereby waive any defenses to the enforcement of the terms of this Agreement based on the foregoing forms of signature.

13. Seals

IN WITNESS WHEREOF, the parties have hereunto set their hands and seals, and such of them as are corporations have caused these presents to be signed by their duly authorized officers.

**Rock River Water Reclamation District
Winnebago County, Illinois**

(Seal)

By _____
President, Board of Trustees

ATTEST: _____
Clerk of the Board

Contractor

(Corporate Seal)

By _____
Contractor's Officer

Name: _____

Title: _____

Date: _____

ATTEST: _____

Not to be used for bidding purposes

Labor & Material Payment Bond

TO: _____ Contractor Name

_____ Contractor City, State

KNOW ALL MEN BY THESE PRESENTS

That _____ (Contractor)

as Principal, and _____

a corporation of the State of _____ as Surety, are held and firmly bound unto the Rock River Water Reclamation District, as Obligee, for the use and benefit of claimants as hereinafter defined in the amount of

_____ Dollars (\$ _____), for the payment where of Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, Principal has by written agreement dated _____ 20__ Entered into a Contract with Obligee for _____ in accordance with contract documents prepared by the Rock River Water Reclamation District which Contract is by reference made a part hereof, and is hereinafter referred to as "the Contract".

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION is such that if Principal shall promptly pay for all laborers, workers and mechanics engaged in the work under the Contract, and not less than the general prevailing rate of hourly wages of a similar character in the locality in which the work is performed, as determined by the State of Illinois Department of Labor pursuant to the Illinois Compiled Statutes 280 ILCS 130 / 1-12 et.seq. and for all material used or reasonably required for use in the performance of the Contract, then this obligation shall be void; otherwise it shall remain in full force and effect.

1. A claimant is deemed as any person, firm, or corporation having contracts with the Principal or with any of Principal's subcontractors for labor or materials furnished in the performance of the Contract on account of which this Bond is given.
2. Nothing in this Bond contained shall be taken to make the Obligee liable to any subcontractor, material man or laborer, or to any other person to any greater extent than it would have been liable prior to the enactment of The Public Construction Bond Act, approved June 20, 1931, as amended; provided further, that any person having a claim for labor and materials furnished in the performance of the Contract shall have no right of action unless he shall have filed a verified notice of such claim with the Obligee within 180 days after the date of the last item of work or the furnishing of the last item of materials, which claim shall have been verified and shall contain the name and address of the claimant, the business address of the claimant within the State of Illinois, if any, or if the claimant be a foreign corporation having no place of business within the State the principal place of

business of the corporation, and in all cases of partnership the names and residences of each of the partners, the name of the Contractor for the Oblige, the name of the person, firm or corporation by whom the claimant was employed or to whom such claimant furnished materials, the amount of the claim and a brief description of the public improvement for the construction or installation of which the contract is to be performed. No defect in the notice herein provided for shall deprive the claimant of its right of action under the terms and provisions of this Bond unless it shall affirmatively appear that such defect has prejudiced the rights of an interested party asserting the same.

3. No action shall be brought on this Bond until the expiration of 120 days after the date of the last item of work or of the furnishing of the last item of material except in cases where the final settlement between Oblige and the Contractor shall have been made prior to the expiration of the 120 day period, in which case action may be taken immediately following such final settlement; nor shall any action of any kind be brought later than 6 months after the acceptance by the Oblige of the work. Such suit shall be brought only in the circuit court of this State in the judicial district in which the Contract is to be performed.
4. Surety hereby waives notice of any changes in the Contract, including extensions of time for the performance thereof.
5. The amount of this Bond shall be reduced by and to the extent of any payment or payments made in good faith hereunder.
6. The Principal and Surety shall be liable for any attorneys' fees, engineering costs, or court costs incurred by the Oblige relative to claims made against this Bond.

Signed and Sealed this _____ day of _____, 2019.

CONTRACTOR SURETY
Contractor Firm Name

By: _____
Signature

By: _____
Attorney-in-Fact

Title Resident Agent

ATTEST:

Corporate Secretary (Corporations only)

Performance Bond

KNOW ALL MEN BY THESE PRESENTS, that WHEREAS, the Rock River Water Reclamation District has awarded to: _____ hereinafter designated as the “Principal”, a contract, dated, _____, for the Rock River Water Reclamation District.

WHEREAS, said Principal is required under the terms of said Contract to furnish a bond for the faithful performance of said Contract (the “Bond”);

NOW, THEREFORE, we the Principal and _____, as Surety, are firmly bound unto the Rock River Water Reclamation District in the penal sum of _____ Dollars (\$ _____) lawful money of the United States for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally firmly by these presents for a performance bond. The conditions of this obligation is such that if the said Principal does well and faithfully performs all the conditions and covenants of said Contract, according to the true intent and meaning thereof, upon its part to be kept and performed, then the above obligation is to be null and void, otherwise to remain in full force and effect.

THE CONDITION OF THIS OBLIGATION IS SUCH, that if the above bounden Principal, its heirs, executors, administrators, successors or assigns, shall in all things stand to and abide by, and well and truly keep and perform the covenants, conditions and agreements in the said Contract, including the provisions for liquidated damages in the said Contract, any changes, additions or alterations thereof made as therein provided, on its part, to be kept and performed at the time and in the manner therein specified, and in all respects according to their true intent and meaning, and shall indemnify and save harmless the Rock River Water Reclamation District, its officers and agents, as therein stipulated, then this obligation shall become null and void; otherwise it shall be and remain in full force and effect. And the said Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the Contract or to the work to be performed thereunder or the specifications accompanying the same and no inadvertent overpayment of progress payments shall in any way affect its obligations on this Bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the Contract or to the work or to the specifications or of any inadvertent overpayment of progress payments. The Rock River Water Reclamation District shall be named as beneficiary on this Performance Bond.

IN WITNESS WHEREOF, the above-bounden parties have executed this instrument under their seal this _____ day of _____, 20_____, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

CONTRACTOR

SURETY

Contractor Firm Name: _____

By: _____

By: _____ Signature

Attorney-in-Fact

Title

Resident Agent

ATTEST:

Corporate Secretary (Corporations only)

Not to be used for bidding purposes

Section III

Section 11304 from
Bid Doc. No. 19-408
Invitation to Bid
RAS Pumping Equipment
Capital Project No. 1859

SECTION 11304

SUBMERSIBLE SOLIDS HANDLING PUMPS AND APPURTENANCES

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. Provide, inspect, and test ten (10) identical submersible solids handling pumps, motors, and appurtenances as indicated and specified, along with an identical shelf spare pump.
- B. The scope of supply for each of the ten (10) pumps includes a discharge base, guide rails, guide rail assembly, lifting chain, access hatch, control panel, submersible cable with kellum type grip, testing reports, and O&M manuals.

1.02 RELATED WORK:

- A. Section 01300: Submittals
- B. Section 01400: Quality Assurance
- C. Section 01600: Control of Materials

1.03 REFERENCES:

- A. ANSI: American National Standards Institute
 - 1. ANSI B16.1: Standard for Cast Iron Pipe Flanges and Flanged Fittings, 125 lb.
- B. ASTM: American Society for Testing Material.
 - 1. ASTM A48: Specification for Gray Iron Castings.
 - 2. ASTM A126: Standard Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
 - 3. ASTM A322: Specification for Carbon and Alloy Steel Bars.
 - 4. ASTM A536: Specification for Ductile-Iron Castings.
 - 5. ASTM A743: Specification for Castings, Iron-Chromium, Iron-Chromium Nickel, and Nickel-Base Corrosion-Resistant for General Application.
- C. Anti-Friction Bearing Manufacturers Association (AFBMA):

1. Standard 9-90 Load Ratings and Fatigue Life for Ball Bearings.
2. Standard 11-90 Load Ratings and Fatigue Life for Roller Bearings.

D. Hydraulic Institute, Current Edition.

E. NEMA: National Electrical Manufacturer's Association.

1.04 SCHEDULE:

- A. Shop drawings shall be submitted, reviewed, resubmitted, and approved within six (6) weeks of Notice to Proceed (NTP). This schedule shall allow one (1) week for each Owner review.
- B. Equipment shall be delivered to the site within the shorter of twelve (12) weeks from shop drawing approval or eighteen (18) weeks from NTP.
- C. Failure to deliver within the indicated time shall result in liquidated damages of \$300 per calendar day until delivery is completed.
- D. Field service requirements shall be complete within six (6) months of equipment delivery.

1.05 SYSTEM DESCRIPTION:

- A. Pump capacities and operating data are indicated herein.
- B. Pumps are to move return activated sludge from final clarifier tanks to aeration tanks. Four RAS pumps discharge into a common piping system discharging to 2 aeration tanks.
- C. Motors to be submerged under all normal operating conditions.
- D. Pumps will be operated automatically through an existing variable frequency drive, based on controls actuated by changes in plant influent flow rates and operator inputs.

1.06 SUBMITTALS:

- A. Shop Drawings: Submit following in accordance with Section 01300 - SUBMITTALS:
 1. Certified shop and erection drawings.
 2. Data regarding pump and motor characteristics and performance:
 - a. Prior to fabrication and testing, provide guaranteed performance curves based on shop tests of a mechanically similar pump, showing it meets specified requirements for head, capacity, horsepower, efficiency, and NPSH. Provide

catalog performance curves at 40%, 60%, 80%, and 100% of the motor speed.

- b. Provide catalog performance curves at required speed showing maximum and minimum impeller diameters available.
 - c. Results of certified performance and witness tests as specified.
 - d. Submit curves for guaranteed performance, certified test, and witness tests on 8-1/2-in. by 11-in. sheets, with one curve per sheet.
3. Shop drawing data for accessory items.
 4. Templates or certified setting plans, with tolerances, for anchor bolts.
 5. Manufacturer's literature as needed to supplement certified data.
 6. Operating and maintenance instructions and parts lists.
 7. Certified results of hydrostatic testing.
 8. Certified results of dynamic balancing.
 9. List of recommended spare parts other than those specified.
 10. Bearing Life: Certified by the pump manufacturer.
 11. Pump shop test results.
 12. Motor shop test results.
 13. Recommendations for short and long-term storage.
 14. Shop and field testing procedures and equipment to be used.
 15. Special tools.
 16. Schematic control and power wiring diagrams.
 17. Provide a scaled drawing showing pumps and motors, include equipment weights, lifting attachments, and clearances for equipment removal and maintenance.
 18. Material Certification:
 - a. Provide certification from the equipment manufacturer that the materials of construction specified are recommended and suitable for the service conditions specified and indicated. If materials other than those specified are proposed

based on incompatibility with the service conditions, provide technical data and certification that the proposed materials are recommended and suitable for the service conditions specified and indicated including an installation list of a minimum of five (5) installations in operation for a minimum of five (5) years. Provide proposed materials at no additional cost to the Owner.

B. The pump supplier is responsible for all modifications required to make their equipment workable with the project design and site conditions. A copy of the construction documents including mechanical process, electrical, and instrumentation drawings, shall be marked to show all changes necessary for the equipment proposed for this specification section. If no changes are required, mark each drawings with "No changes required" or provide a statement that no changes are required.

1. The pump sump area and the pump access hatch size are critical to the equipment and to the structural integrity of the final project. Equipment requiring a larger access hatch shall include structural design and upgrades to the elevated concrete slab by the equipment provider, at no additional cost to the Owner. Any such changes require approval of the Engineer.

2. Failure to include all drawings, or a statement applicable to all drawings for the equipment specified in this section, will result in submittal return without review until a complete package is submitted.

C. Location of nearest authorized motor service center.

1.07 QUALITY ASSURANCE:

A. Provide in accordance with Section 01400 and as specified herein.

B. All pumps shall be the product of one manufacturer.

C. Pumps shall be manufacturer's standard cataloged product and modified to provide compliance with drawings, specifications, and service conditions specified and indicated.

D. Welding: In accordance with latest applicable American Welding Society Code or equal.

E. Shop tests as specified.

F. The pumps, motors, guide rails, hatches, controls, and control panels shall be provided from a single pump manufacturer, as a complete and integrated package to insure proper coordination, compatibility, and operation of the system.

G. Services of Manufacturer's Representative as stated in Section 01300 and specified herein.

H. Provide services of factory-trained Service Technician, specifically trained on type of equipment specified:

1. Service Technician must have a minimum of five (5) years of experience, all within the last seven (7) years, including work on the type and size of equipment herein.
 2. Service Technician must be present on site for all items listed below. Person-day requirements listed are exclusive of travel time, and do not relieve Manufacturer of the obligation to place equipment in operation as specified.
 3. Installation: Supervise location of anchor bolts; setting, leveling, alignment, field erection; coordination of piping, electrical, and miscellaneous utility connection:
 - a. 1 person-day for first pump.
 4. Functional and Field Performance Testing: Calibrate, check alignment, and perform a functional test with secondary wastewater. Tests to include all items specified.
 - a. 2 person-days, one day trip for first pump installed and one day trip for sixth+/- pump installed.
 5. Vendor Training: Provide field operation and maintenance instruction including all materials, slides, videos, handouts, and preparation; provide in two separate sessions one for first shift and one for second shift.
 - a. 1 person-day, one separate trip, after first pump is installed.
 6. If manufacturer requires factory service technician to place each pump or controls into service for warranty or other reasons, the manufacturer shall provide such services at no additional cost to the Owner based on the assumption that two pumps will be placed into service at a time on five separate events. Any additional time required of the factory trained service technician to assist in placing the equipment in operation, or testing, or to correct deficiencies in installation, equipment, or material shall be provided at no additional cost to the Owner.
- I. If equipment proposed is wider or longer than the specified unit, provide all structural, architectural, electrical, and mechanical revisions at no additional cost to the Owner. Design shall be approved by Owner and shall be sealed by a Structural Engineer licensed in the State of Illinois.

1.08 DELIVERY, STORAGE AND HANDLING:

- A. Provide as specified herein.
- B. Shipping:

1. Ship equipment and spare parts complete except where partial disassembly is required by transportation regulations or for protection of components.
2. Pack spare parts in containers bearing labels clearly designating contents and pieces of equipment for which intended.
3. Deliver spare parts to Owner along with the equipment.
4. Phasing of equipment delivery will be considered by Owner, if necessary to get a portion of the order to the site more rapidly. However, at least 2 complete sets of pumps and appurtenances shall be included with each delivery.

1.09 SPECIAL REQUIREMENTS:

A. Refer to the applicable specification sections with regard to providing the following:

1. Foundations, Installations, and Grouting as specified in Section 01600.
2. Lubricants as specified in Section 01300.
3. Special Tools as specified in Section 01300.
4. Bolts, Anchor Bolts, and Nuts as specified in Section 01600.
5. Concrete Inserts and Sleeves as specified in Section 01600.
6. Nameplates as specified in Section 01300.
7. Operating and maintenance manual specified in Section 01300.

1.10 WARRANTY:

- A. Warranty on all pumps and equipment shall be at least 2 years from the date of start-up or 30 months from the date of receipt at the site.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

- A. Xylem - Flygt
- B. Sulzer - ABS
- C. Fairbanks Morse

- D. The design is based on Flygt equipment, which provides the minimum allowable requirements. All changes required as a result of using a different manufacturer's equipment are the responsibility of the Bidder and require District approval.

2.02 PUMP CONSTRUCTION:

- A. Pumps: Solids Handling single-stage, submersible centrifugal pumps.

- B. Each pump capable of delivering 2,000 gpm at 16 feet TDH with at least 68% pump efficiency at this design point and capable of delivering 1,000 gpm at 7 feet TDH at a stable reduced speed without overheating and without other operational issues.

- C. Pump Volute, Casing, Fronthead, and Backhead:

1. Cast iron ASTM A48 minimum Class 35B capable of prolonged resistance to abrasive action of solids and foreign matter contained in pumped liquid.
2. Provide lifting devices on pump/motor assembly for handling.
 - a. Type 316L stainless steel.
3. Provide ribs or reinforcing as required to withstand the specified hydrostatic test pressure, to prevent deflection caused by hydraulic thrust, and to support the motor.
4. Pump discharge connection to be 10" diameter.
5. Face and drill flanges of discharge connections in accordance with 125-lb. ANSI Standard.
6. Provide components with machined registered concentric shoulder fits for precision alignment. Equipment without registered fits is not acceptable.

- D. Impeller:

1. Type: Single suction, semi-open, multi-vane, back swept, screw shaped, non-clog solids handling.
2. Provide vanes having wide suction and waterways and well rounded entrances that will pass solids and stringy materials without clogging. Pumps capable of passing a minimum 3-inch diameter sphere.
3. Impellers provided shall be a proven design and shall not be greater than 90% of the maximum diameter impeller available at the indicated pump rating point.
4. Material to be hardened ASTM A532 Alloy III A 25% chrome cast iron.

5. Key-seat and hold impeller to shaft by a corrosion resistant streamlined bolt or locknut capable of holding in event of motor reversal under full torque.
6. Statically and dynamically balance each impeller.

E. Wearing Rings:

1. Provide on impeller and in pump volute at suction side.
2. Wearing Rings: Shall be of hard iron high chrome and hardness that will protect the impeller and volute, with the impeller ring (if so equipped) generally wearing prior to the volute ring.
3. Clearance adjustable with a trim screw.

2.03 MOTORS:

- A. Provide motors as specified and required.
- B. Horsepower rating of motors: Pump and motor horsepower shall be compatible with the existing electrical system. Motor shall not operate into the motor service factor under the pump's maximum brake horsepower requirement under any condition of operation specified.
- C. Maximum motor design speed not to exceed 1,200 rpm.
- D. Enclosure: Submersible, premium efficiency.
- E. In addition to the requirements for bearings, provide pump motors with ball or roller bearings. Provide vertical motors with at least one bearing designed specially for thrust. Provide ball or roller bearings, in accordance with AFBMA Standard 9-90 and Standard 11-90; minimum L-10 life of 50,000 hours or as specified.
- F. Operate without overheating at the speeds specified and indicated.
- G. Service Factor: 1.15
- H. Nominal and minimum efficiencies per NEMA MG1.
- I. Rating: 15 horsepower, 460 volt, 3 phase, 60 hertz with FLA \leq 23 amps.
- J. Motor Construction:
 1. Provide electric submersible NEMA B design squirrel cage induction motors.

2. Provide all components housed in an air filled cast-iron watertight enclosure sealed by O-rings and shall have rabbet joints with a large overlap.
3. Insulate stator-winding and lead with moisture resistant Class H insulation rated for 180 deg. C duty temperature. Stator shall be insulated with the trickle impregnation process with winding fill factor greater than 95%.
4. Provide inverter duty rated motor per NEMA MG1 Part 31.
5. Class F insulation and de-rating the motors for VFD operation will not be allowed.
6. Motor shaft: Type 431 stainless steel per ASTM A479, one piece integral pump/motor shaft.
7. Dynamically balance rotor to within NEMA vibration limits.
8. All hardware: Type 316 stainless steel.
9. Provide multi-conductor cables in sufficient length to extend from pump motor to the pump control panel above top of wet well plus 5 feet as indicated. Power cables shall be suitable for use with a VFD. Cable size in accordance with NEC.
10. Cables and cable seals shall be water-tight and suitable for at least 50' continuous submergence in wastewater.
11. Provide a means of cable support with a stainless steel kellum-type cable grip, for attachment at the pump rail system upper bracket.
12. Seals:
 - a. Provide two separate tandem-mounted mechanical seals with the upper and lower seals mounted to rotate in the same direction.
 - b. Upper Seals:
 - (1) Provide seal completely immersed in an oil bath sealing the oil chamber and motor housing.
 - (2) Materials: Corrosion and abrasion resistant with tungsten-carbide faces, one face rotating and once face stationary.
 - c. Lower Seals:
 - (1) Provide lower seal with mating faces immersed in the oil bath sealing the pump volute and oil chamber.

- (2) Materials: Tungsten carbide rotating and stationary faces.
- (3) Provide a cover extending completely over the lower seal spring.
- d. Springs: Type 316 stainless steel.
- e. Elastomers: Viton.
- f. Provide a seal lubricant chamber. The seals shall not rely on the pumped fluid for lubrication.
13. Moisture and Temperature Probes:
- a. Provide a moisture detection system to detect moisture past the upper mechanical seal prior to entering the motor stator cavity. Moisture detection shall alarm at the pump control panel and shall include all the required control components to drive the moisture sensor and for control from the moisture sensor. Wiring shall be integral with the pump power cable between the motor and the pump control panel.
- b. Provide O-ring-sealed plugged fill and drain inspection ports.
- c. Provide 3 thermal switches embedded in the stator, one for each phase, for monitoring stator temperature. Stator over temperature shall alarm at the pump control panel and shall include all required control components to drive and control motor temperature. Wiring shall be integral with the pump power cable between the motor and the pump control panel.
- d. Over temperature shall shut down the pump, indicate condition, and alarm.
- e. Moisture detection shall indicate condition and alarm.
14. Integral Pump/Motor Bearings:
- a. Provide a minimum of two bearings permanently lubricated but capable of being re-greased.
- b. Two row angular contact ball bearings. Upper bearing for radial loads and lower bearing for both thrust and radial forces.
- c. Minimum L-10 bearing life of 50,000 hours at all conditions on pump curve.
15. Provide all mating surfaces machined and fitted with O-rings. All fittings shall be metal to metal contact between each machine surface.

16. Provide a Type 316 lifting attachment and hardware capable of lifting the entire pump and motor assembly.
17. Motors shall conform to UL quality assurance specifications and be manufactured by an ISO-9001 company.
18. Motors with written 5-year warranty against defects in materials and workmanship, including specific schedule of manufacturer's terms, covering both parts and labor.

2.04 DISCHARGE BASE:

- A. Provide an ASTM A48 Class 35B cast iron discharge base assembly including a 90-degree elbow and base to support the entire weight of the pump and motor.
- B. Base shall secure the lower end of the guide rails.
- C. Provide base with 125-lb ANSI flange discharging vertically.
- D. Provide base machined to receive sliding bracket of pump discharge.
- E. Provide metal to metal seat that is self-cleaning, non-clogging, and non-sparking. Non-metallic sealing methods are not acceptable.
- F. Provide anchors for bolting to concrete floor; anchors shall be Type 316 stainless steel, secured with epoxy adhesive.

2.05 GUIDERAIL ASSEMBLY:

- A. Furnish Schedule 40 Type 316L stainless steel guide rails for each pump discharge assembly. Rail size to be manufacturer's standard but not less than 2-inch diameter rails.
- B. Provide intermediate supports for guide rails; supports to be Type 316L stainless steel. Maximum spacing between supports shall not exceed 10 feet. Guiderail supports shall attach to the 10" diameter ductile iron discharge piping.
- C. Furnish a Type 316L stainless steel top guide rail retainer bracket to support the guide rails. Bracket to be attached to top slab of wet well.
- D. Provide Type 316 stainless steel chain of sufficient length, to reach from pump to top of wet well plus 5 feet and of strength for lifting pump and motor. Provide chain designed for attachment to lifting lugs provided on motor and to the guide rail retainer bracket.

2.06 ACCESS HATCHES:

- A. Each pump shall be provided with a single door access hatch to be cast into an existing reinforced concrete slab.

- B. Hinged plate cover and frame of sufficient size for installation and removal of pump. Minimum acceptable size is indicated on drawings however if a different pump is used, the cover shall be sized to provide 4" of clearance on all sides of the pump. A single leaf cover was selected to minimize required slab opening. Larger slab penetration than shown requires an independent structural evaluation and report to guarantee that the larger opening will not reduce structural load capacity of the elevated slab, at no additional cost to Owner.
- C. Aluminum angle frames with welded strap anchors or channel frames, for securing in concrete. Miter corners, weld joints, and grind welds smooth where exposed.
- D. Aluminum tread plate covers with acceptable nonskid surface, reinforced with aluminum bars welded to underside of cover details. Covers fit neatly and accurately in frames.
- E. Hinged: Hinge covers to frames with stainless steel, heavy duty plain bearing hinges and stainless steel pins. Attach hinges to covers and frames with stainless steel machine screws, provide flush lift handles made from 1/2-in. dia. 6061-T6 alloy rod. Provide quick release latching device to hold leaf in open position.
- F. Mill finish, bituminous coating applied to exterior of the frame for protection from contact with Portland cement concrete.
- G. Hatch loading capacity:
1. 300-lbs per square foot.
- H. Provide a latching lock to secure the cover in the closed position. Lock to be operated from the outside by a removable key wrench and a fixed handle for operation from inside the cover. Do not provide padlock tabs above the surface that create a trip hazard
- 2.07 **HARDWARE:** All pump hardware and ancillary equipment hardware shall be Type 316 stainless steel.
- 2.08 **CONTROL SYSTEM:**
- A. Instrumentation and Control:
1. Each pump will be powered through an existing variable frequency drive, located in the Aeration Building, remote from the pump. The VFD shall communicate with and provide pump power through a pump manufacturer provided local pump control panel, for each pump.
 2. Pump manufacturer to provide a Pump Control Panel, NEMA 4X Type 316 stainless steel with a local disconnect for each pump, 120-volt power from a relay in the plant control system, solid state, reset buttons, relays, switches, contacts,

indicating and alarm lights, and all necessary appurtenances, factory wired to provide a complete operating set of control. Provide intrinsically safe relays.

- a. Red running lights
- b. Green off lights
- c. Amber alarm lights

B. Equipment, cabinets, and all devices provided shall be of the heavy-duty type, rated for continuous 24-hour industrial duty. The system shall consist of currently in production products of a single manufacturer wherever possible.

C. Panels furnished under this section shall be of the design and arrangement as indicated and specified. The pump panel's control switches and indicating lights shall be mounted on the outside of the panel door when feasible. Access doors (or access panels), shall have continuous Type 316 stainless steel hinges, with quick opening latching devices.

1. Surfaces containing instruments shall be fabricated from 11 gauge Type 316 stainless steel, reinforced to prevent wracking or distortion.
2. Provide terminal strips numbered with the signal termination numbers indicated on the approved shop drawings. Provide wire numbers indicated on wires at terminal blocks and all connections.
3. Partition intrinsically safe wiring separately from all other wiring. Provide a protective cover with labeling to cover the intrinsically safe wires.
4. Provide electronic equipment of the manufacturer's latest design and coated to prevent contamination by dust, moisture, or fungus. Provide field mounted equipment and system components suitable for dusty, humid, corrosive conditions.
5. Number wiring in accordance with the numbering system used on the approved instrument drawings.
6. Group wiring within the panel according to function.
7. Provide wiring as specified in ISA S-5.4.
8. Provide DPDT switches with contacts rated for 600 VA minimum.
9. Design the system and equipment used therein to resume normal operation without manual intervention, following resumption of power after a power failure.
10. Provide protection for 120 VAC operated equipment. Protect panels, cabinets, groups of equipment, and other enclosures against damaging disturbances by individual isolation transformers, surge suppressors, or gas-tube suppressors.

11. Where required to maintain intrinsically-safe rating, passive devices designed for the purpose shall be installed according to the equipment or device manufacturer's instructions. Safety barriers shall not require any external voltage supply and shall include series resistors and fuses and shunting zener diodes that will limit the transfer of energy to levels classified as "intrinsically safe" by Factory-Mutual.
12. Provide internal panel components mounted directly on the inside surfaces, but on removable plates made of the same material and finish as the panel, of a thickness to provide support for mounted components.
13. Attach identification labels to all internal components.
14. Provide oil-tight, heavy-duty momentary contact pushbuttons, rated for 10 amperes at 120 VAC. Supply with the quantity of poles required for the application.
15. Rotary selector switches used for controlling 120 VAC, shall be oil-tight, heavy-duty, maintained contact type rated for 10 amperes at 120 VAC.
16. Provide print storage pocket on inside panel surface to hold all documents to be used in servicing the equipment.
17. Provide oil-tight, heavy duty, transformer-operated LED pilot lights, with average life of 10,000 hours.
18. Panel relays shall be plug-in, with transparent covers, and shall contain an indicating light to indicate its' operation. Contacts shall be rated for 10 amperes at 120 VAC. Life expectancy shall be 10 million operations.
19. Provide solid-state timers of the plug-in, digital type with output contacts rated for 10 amperes at 120 VAC. Life expectancy shall be 10 million operations.
20. Provide 14 AWG copper panel wire, control wire, and 12 AWG power wire, type THWN stranded copper, and insulated for 600 volts.
21. Provide terminal strips in existing panel for pump power. Extend pump power wires from existing panel to new pump control panel, without splicing. New wiring to match size of existing power wires. Wiring to each pump shall be easily disconnected from inside the local pump control panel to facilitate pump removal.
22. Provide terminal blocks of corrosion proof material such as nickel plated copper. Provide AC and DC control terminals suitable for #12 AWG or larger wire. Provide terminals for DC analog signals suitable for #16 AWG wire.
23. Wire colors shall be assigned as follows:

- a. AC Power Black
 - b. AC Neutral or Common White
 - c. AC Control Red
 - d. DC Control Blue
 - e. Equipment or Panel Ground. Green
 - f. Externally Powered Circuits Orange
24. Provide internal wiring troughs of the plastic, open-side type with snap-on covers. The open sides shall permit wire movement without disconnecting it.
25. Wire connectors shall be the hook-fork type, with non-insulated barrel to allow inspection of crimp integrity.
26. Direct interlock of equipment is not acceptable.
27. Use only one side of each terminal block row for internal wiring. Use the other side for field wiring. Do not locate terminal blocks within 6 inches of any panel at right angles to them.
28. Provide all relays not provided under other Divisions but required for properly providing the control function defined in this Section.
- a. An example of this requirement is: ON and OFF pilot lights may be controlled by a single pair of wires from a single contact for both conditions; a relay will therefore be required to provide NO and NC contact for both pilot lights. Such relays shall be mounted in their respective control cabinets, and shall be clearly marked as being powered outside of the panel's normal circuit breaker.
29. Provide engraved 1 inch by 3 inch lamicoïd nameplates, black letters on white background, for all flush mounted panel equipment.
30. Provide engraved lamicoïd nameplate, black letters on white background, for each pump control panel (PUMP RSP-1, PUMP RSP-2, PUMP RSP-3, PUMP RSP-4, PUMP RSP-7, PUMP RSP-8, PUMP RSP-9, PUMP RSP-10, PUMP RSP-11, PUMP RSP-12).
31. All AC and DC powered devices in panels shall have current fuses or circuit breakers. All protective devices shall be located in groups at one location in the panel. All devices shall be labeled. AC and DC fuse banks or circuit breaker banks shall be in separate locations of the panel.

32. For all signals to be transferred to/from another panel, provide current isolators (analog) or dry relay contacts (discrete) wired out to terminal blocks.
33. Push Button and Selector Switch Stations:
- a. Provide pushbutton and selector switch stations designed for heavy-duty service and with momentary or maintaining contacts as indicated or as necessary for starting and stopping of equipment with 10 amp contact ratings.
 - b. HAND-OFF-AUTO selector switch shall be equipped with contact blocks for relay of position indication to the Plant Control System.
34. Circuit Breakers:
- a. Provide manually operable circuit breakers and provide thermal-magnetic, inverse-time-limit overload, and instantaneous, short-circuit protection. U.L. listed circuit breakers conforming to NEMA Standard ABI.
35. Alarms:
- a. Individually sensed and visually indicated locally.
 - (1) High temperature, each pump motor (to alarm and shut pump off)
 - (2) Moisture detection, each pump motor (to alarm)
 - b. Provide alarm contacts for remote signal of alarm conditions.
36. Provide terminal board for all-external circuits

2.09 SHOP TESTING:

A. Pump Tests:

1. Hydrostatically test each pump casing under a hydrostatic head of 75 psi or 150 percent of rated shutoff head, whichever is greater.
2. Provide certified performance tests for all pumps. Test two (2) of the identical pumps. If modification is required to either of the two test pumps, such modifications shall be made to all of the project's pumps. And, every pump shall then be tested after the modifications are completed, at no additional cost.
3. Testing.
 - a. Run pump at full speed rating point for 60 minutes prior to start of any testing.

- b. Full speed test: Test pump at specified conditions and take not less than five operating points between shut-off and run out. Take readings to determine flow, differential pressure, rpm, horsepower, and efficiency. Also, operate each pump for not less than one hour and take readings to determine that the pump will operate as specified and indicated without cavitation at the specified minimum head condition with not more than the specified NPSH available.
 - c. Reduced speed tests: generate a family of curves for pump operation at various speeds, including a curve at speed that satisfies the low flow design point.
4. Run all tests in accordance with the latest standards of the Hydraulic Institute and as specified.
 5. In the event that specified tests indicates that pump or motor will not meet specifications, the Engineer has the right to require complete witnessed tests for all pumps, and motors at no additional cost to the Owner.
 6. Repeat tests until specified results are obtained.
 7. Correct or replace promptly all defects or defective equipment revealed by or noted during tests.

2.10 SHOP PAINTING:

- A. Primer and Finish Paint: Shop apply to all exterior ferrous surfaces, manufacturers standard paint.
 1. Color: Manufacturer's standard coating system and color.
- B. Surface preparation, mixing, application, and safety requirements shall be in accordance with the paint manufacturer's printed instructions.
- C. Ferrous surfaces which are not to be painted shall be given a shop applied coat of grease or rust resistant coating.

2.11 SPARE PARTS:

- A. Provide spare parts that are identical to and interchangeable with similar parts installed.
 1. Two complete sets of mechanical seals.
 2. Two complete sets of gaskets.
 3. One complete spare pump and motor, identical to the 10 pumps required.
 4. One set of all special tools required for maintenance and repair.

5. One quart of paint matching the pump paint system, for touch-up of defects in the factory applied paint system resulting from handling and installation.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Provide installation instructions for all items provided under this section. All materials will be installed by Owner's Contractor, in accordance with the printed instructions of manufacturers, as indicated, and specified.

3.02 FIELD TESTING:

- A. Test removal and replacement of pumps to prove the pumps are properly installed and aligned.
- B. After installation of pumping equipment, and after inspection, operation, testing, and adjustment have been completed by manufacturer's field service technician, conduct running test for each pump in presence of the Engineer to determine its ability to deliver its rated capacity under specified conditions. During tests, observe and record head, capacity, motor inputs. Immediately correct or replace all defects or defective equipment revealed by or noted during tests at no additional cost to the Owner. Repeat tests until specified results are obtained. Contractor to provide all labor, piping, equipment, flowmeters, test gauges, and materials for conducting tests.
- C. Adjust secondary functions, such as alarm actuations, during initial calibration and demonstrate after system is placed in service.

END OF SECTION

Not to be used for bidding purposes

Section IV

General Provisions & Technical Specifications for Sanitary Sewer Construction

(Separate document incorporated by reference)

Special Condition

Special Conditions

G.C. 6:1 Limitations and Consent

The District reserves the right to limit the total amounts of subcontracts to seventy-five percent (75%) of the total contract price.

Not to be used for bidding purposes